

# United States Department of the Interior

## FISH AND WILDLIFE SERVICE

Ecological Services  
WinSystems Center Building  
711 Stadium Drive, Suite 252  
Arlington, Texas 76011

September 23, 2002

Colonel Gordon M. Wells  
District Engineer  
U.S. Army Corps of Engineers  
(Attn: CESWF-EV-EE)  
P.O. Box 17300  
Fort Worth, Texas 76102-0300

Re: Draft Fish and Wildlife Coordination Act report on the U.S. Army Corps of Engineers' Riverside Oxbow Ecosystem Interim Feasability Study in Fort Worth, Tarrant County, Texas

Dear Colonel Wells:

Enclosed for your information and review is the U.S. Fish and Wildlife Service's (Service) draft report on the Riverside Oxbow Ecosystem Interim Feasability Study within the City of Fort Worth, Tarrant County, Texas. Field investigations were conducted in April 2001, and February and April 2002, by the U.S. Fish and Wildlife Service Field Office in Arlington, Texas in cooperation with your Environmental Resources planning staff and the Texas Parks and Wildlife Department (TPWD). The Service's Habitat Evaluation Procedures (HEP) was used for the analysis and evaluations. Personnel of your agency have worked closely with our office in deriving this presented data. Our final FWCA report will be coordinated with the TPWD and submitted to accompany your final Detailed Project Report. Please provide any review comments on our draft report at your earliest convenience.

The Service appreciates the opportunity to participate in the planning of this project. Please contact Carol S. Hale of my staff at the above address or telephone number (817) 277-1100 if you have any questions or require additional assistance.

Sincerely,

Thomas J. Cloud, Jr.  
Field Supervisor

enclosure

## **Executive Summary**

This Fish and Wildlife Coordination Act Report (Report) provides the U.S. Fish and Wildlife Service's evaluation of the effects of the proposed actions included in the Riverside Oxbow Ecosystem Restoration Feasibility Study on fish and wildlife resources. The purpose of this report is to identify and describe existing fish and wildlife resources, possible project impacts to these resources under each alternative, restoration opportunities within the proposed project area, and to recommend fish and wildlife resources mitigation and enhancement measures. It has been coordinated with and reviewed by the Texas Parks and Wildlife Department (TPWD).

The Riverside Oxbow Study is part of the comprehensive Clear Fork and West Fork of the Trinity River Interim Feasibility Study initiated by the U.S. Army Corps of Engineers (Corps) in 2000. The Clear Fork \ West Fork Study is being conducted by the Corps under the authority of a resolution by the United States Senate Committee on Environment and Public Works, dated April 22, 1988. Studies were initiated at the request of Tarrant Regional Water District where plans are being made to reduce flood damage, restore ecosystems, and provide additional and improved recreational opportunities along the West and Clear Forks of the Upper Trinity River and its tributaries. The Riverside Oxbow Study is the first of several feasibility studies in this area to be conducted over the next ten years. The purpose of this study is to identify opportunities to restore the quality, quantity and diversity of the wildlife habitats, improve water quality, and restore and sustain ecological functions within the Riverside Oxbow Study area.

The Riverside Oxbow Study area is located along the West Fork of the Trinity River approximately one mile east of downtown Fort Worth, Tarrant County, Texas. The project area is divided into three sections: Riverside Oxbow, Gateway Park, and Tandy Hills. The natural resources within the study area have been greatly impacted by past flood control projects, industrial and residential development, bridge construction, and agricultural activities. The west portion of the river in the study area runs through a channel that was constructed during a realignment project for flood control, diverting water from the natural river segment known as the Riverside Oxbow. The east portion of the project area is mainly within the City of Fort Worth's Gateway Park consisting of parklands, ballfields, roads and parking lots, and an old wastewater treatment plant. The City owned Tandy Hills Park and adjacent private lands make up the southeast portion of the project area. Tandy Hills is primarily upland habitat and contains the only remnants of the original Fort Worth Prairie within the city limits.

The proposed project involves riparian hardwood forest improvement (133 acres) and reforestation (73 acres); wetland improvement and creation (21 acres); open water creation (28 acres); native grasslands restoration (432 acres); hydraulic restoration in the old Trinity River oxbow; erosion control; and access improvement via construction of trails, parking areas, and canoe channels and launches. Some private land would need to be acquired for completion of the project.



## **Resource Impacts With and Without the Project**

If the proposed plan or some other habitat restoration and preservation action is not implemented, the project area will still change with time depending on natural and human influences. With the “no action” alternative, existing habitats would probably be degraded as development continues in and around the project area. Water quality and biodiversity would be deleteriously impacted by human activities upstream, in the project area, and surrounding lands. Habitat loss due to uncontrolled public use and exotic plant invasion would continue in the Tandy Hills. The land proposed to be acquired would most likely be sold to private industry and developed.

If the proposed project were implemented, wildlife habitats and their quality would increase throughout the study area during the next 50 years. The project would create a larger, more complex ecosystem and higher biodiversity. The riparian bottomland hardwood corridor would be continuous, wider, and contain more food and cover for many resident and migratory wildlife species. The riparian corridors would provide connectivity between two diverse ecosystems, the Tandy Hills upland and the West Fork bottomlands. The quality and quantity of the existing emergent wetlands and tall grasslands would increase. The project would also improve water quality via the proposed erosion control actions, wetland improvements, and widening of the riparian corridor. The completion of any project features discussed in this report is not anticipated to affect any federally listed threatened or endangered species.

## **Service Recommendations**

The following actions are recommended to restore natural habitats impacted by the construction and operation of Corps projects along the Fort Worth Floodway and to help ameliorate many of the secondary impacts from urban development within and adjacent to the project area.

1. The hay fields south of the oxbow and between Beach Street and the ballfields, and portions of the dikes, levees, and parklands should be reseeded and managed as native grasslands. Uncontaminated, fresh top soil may need to be placed where excavation has occurred along Beach Street.
2. A mowing schedule should be developed that promotes tall grass growth, but does not interfere with tall-grass nesting birds.
3. Widen the riparian woodland corridors along the Riverside Oxbow and the main river channel to 330 feet where needed by planting native mast producing trees and shrubs.
4. Provide a year-round water source for the Riverside Oxbow and the old oxbow wetland between the river and the ballfields. We recommend that the oxbow channel not be disturbed (i.e. widening or deepening) in any attempt to improve habitat.
5. Create a wetland complex at the old Sycamore Creek remnant wetland area between the

Riverside Oxbow and the river and improving the large wetland complex between Beach Street and the ballfields in Gateway Park.

6. Improve the new wetland created in 2001 between the river and I-30 just east of Riverside Drive. Native aquatic plants should be established in and around the waters edge.
7. The pond on Beach Street should be maintained, but provided a more reliable water source.
8. If the final laboratory results of the City of Fort Worth's hazardous materials testing shows the old wastewater treatment plant drying beds are free of contaminants, a new wetland complex should be created at this site.
9. Maintaining the Tandy Hills tall grassland habitat should be one of the top priorities of this project. The invading red cedar and exotic privet should be removed and the riparian corridors maintained and restored where impacted. Apply erosion control and restoration techniques in problem areas and the old restaurant site. Construct fencing around the perimeter of the Tandy Hills area.
10. Control bank erosion through use of biological engineering to the extent possible.
11. Develop a plan to eliminate the use of fertilizers, pesticides, and herbicides used on public lands.
12. The proposed project area should be surveyed for the presence of bald eagle roosting or nesting sites. If eagle roost or nest sites are discovered, this office should be contacted to discuss alternate construction plans.
13. Survey for interior least tern nesting within the excavation area on the private land along Beach Street during the breeding season prior to any construction or restoration work in that area. Our office would be willing to assist in developing the survey protocol for this effort.
14. A biological analysis should be conducted every few years using the same habitat evaluation technique to monitor and quantify habitat impacts of the restoration sites.
15. The scissor-tailed flycatcher be used in place of the eastern meadowlark as an indicator species for any future assessments of the Tandy Hills area.

## **Summary**

With the inclusion of these recommendations, this reforestation and wetland creation/restoration project would greatly improve the diversity, quality and quantity of habitats within the project area, thus benefitting a variety of resident and migratory wildlife species.

# TABLE OF CONTENTS

	Page
INTRODUCTION .....	1
DESCRIPTION OF THE STUDY AREA .....	1
PROJECT ALTERNATIVES UNDER CONSIDERATION .....	4
No Action Alternative .....	4
Riverside Oxbow Action Alternatives .....	6
Gateway Park Action Alternatives .....	6
Tandy Hills Action Alternatives .....	7
HABITAT EVALUATION METHODS .....	7
DESCRIPTION OF EXISTING FISH AND WILDLIFE RESOURCES .....	10
Terrestrial Resources .....	13
Riverside Oxbow .....	13
Gateway Park .....	14
Tandy Hills .....	16
Aquatic Resources .....	17
Riverside Oxbow .....	17
Gateway Park .....	18
Tandy Hills .....	19
Endangered Species .....	20
FUTURE WITHOUT THE PROJECT .....	21
Terrestrial Resources .....	21
Aquatic Resources .....	22
FUTURE WITH PROJECT .....	22
Terrestrial Resources .....	23
Riverside Oxbow .....	23
Gateway Park .....	24
Tandy Hills .....	25
Aquatic Resources .....	25
Riverside Oxbow .....	25
Gateway Park .....	26
Endangered Species .....	26

RECOMMENDATIONS .....	26
SUMMARY .....	29
APPENDICES	

## TABLES

	Page
Table 1. Structural habitat composition parameters estimated at each Riparian/Bottomland Hardwood survey site . . . . .	11
Table 2. Structural habitat composition parameters estimated at each Emergent Wetland survey site . . . . .	12
Table 3. Structural habitat composition parameters estimated at each Grassland survey site . . . . .	13
Table 4. Habitat Suitability Index Values and Habitat Units for the Existing Conditions in the Riverside Oxbow for Each Indicator Species . . . . .	14
Table 5. Habitat Suitability Index Values and Habitat Units for the Existing Conditions in Gateway Park for Each Indicator Species . . . . .	15
Table 6. Habitat Suitability Index Values and Habitat Units for the Existing Conditions in the Tandy Hills for Each Indicator Species . . . . .	17
Table 7. Average Annual Habitat Units without Project. . . . .	21
Table 8. Average Annual Habitat Units with Project. . . . .	23

## FIGURES

	<b>Page</b>
Figure 1. Riverside Oxbow Ecosystem Restoration Interim Feasibility Study Area and HEP Sites .....	. 3
Figure 2. U.S. Army Corps of Engineers' National Ecosystem Restoration Plan Map ....	5

**DRAFT**  
**Fish and Wildlife Coordination Act**  
**Section 2(b) Report**  
  
**on the**  
  
**Riverside Oxbow Ecosystem Interim Feasability Study**  
**Tarrant County, Texas**



*Prepared by:*  
Carol S. Hale  
Ecological Services Field Office  
Arlington, Texas

*Reviewed by:*  
Thomas J. Cloud, Jr.  
Field Supervisor

U.S. Fish and Wildlife Service  
Region 2  
Albuquerque, New Mexico  
September 27, 2002

**DRAFT FISH AND WILDLIFE COORDINATION ACT SECTION 2(B) REPORT**  
**on the**  
**RIVERSIDE OXBOW ECOSYSTEM RESTORATION**  
**INTERIM FEASIBILITY STUDY**

**INTRODUCTION**

This report details the effects of the proposed actions included in the authorized Riverside Oxbow Ecosystem Restoration Feasibility Study on the fish and wildlife resources in the project area. It has been prepared under the authority, and in accordance with the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et. seq.), and is the report of the Secretary of the Interior under Section 2(b) of the Act. This report has been coordinated with the Texas Parks and Wildlife Department (TPWD) as noted in the attached letter, dated \_\_\_\_\_, signed by \_\_\_\_\_.

The Riverside Oxbow Study is part of the comprehensive Clear Fork and West Fork of the Trinity River Interim Feasibility Study initiated by the U.S. Army Corps of Engineers (Corps) in 2000. This study is being conducted by the Corps under the authority of a resolution by the United States Senate Committee on Environment and Public Works, dated April 22, 1988. Studies were initiated at the request of Tarrant Regional Water District where plans are being made to reduce flood damage, restore ecosystems, and provide additional and improved recreational opportunities along the West and Clear Forks of the Upper Trinity River and its tributaries. The Riverside Oxbow Study is the first of several feasibility studies in this area to be conducted over the next ten years. The purpose of this study is to identify opportunities to restore the quality, quantity and diversity of the wildlife habitats, improve water quality, and restore and sustain ecological functions within the Riverside Oxbow Study area.

The purpose of this report is to identify and describe existing fish and wildlife resources, possible project impacts to them under each alternative, restoration opportunities within the proposed project area, and to recommend fish and wildlife resources mitigation and enhancement measures. Field investigations were conducted in April 2001, and February and April 2002, by the U.S. Fish and Wildlife Service Field Office in Arlington, Texas in cooperation with the Corps Environmental Resources planning staff and the TPWD.

The project involves riparian hardwood forest improvement (133 acres) and reforestation (73 acres); wetland improvement and creation (21 acres); open water creation (28 acres); native grasslands restoration (432 acres); hydraulic restoration in the old Trinity River oxbow; erosion control; and access improvement via construction of trails, parking areas, and canoe channels and launches. Some private land would need to be acquired for completion of the project.

**DESCRIPTION OF THE STUDY AREA**

The Riverside Oxbow study area is located along the West Fork of the Trinity River



approximately one mile east of downtown Fort Worth. The upstream boundary of the 1,060 acre project area is Riverside Drive and the downstream boundary is 1<sup>st</sup> street. The project area is divided into three sections: Riverside Oxbow, Gateway Park, and Tandy Hills (Figure 1). The Riverside Oxbow section is located between Riverside Drive on the west and Beach Street on the East, and between commercial development and residential areas north of the old river channel oxbow and Interstate Highway 30 (I-30) to the south. The Gateway Park section is located between Beach Street and the riparian buffer on the eastern shore of the river, with 1<sup>st</sup> Street to the north and I-30 to the south. The Tandy Hills section contains the private and municipal land between I-30 on the north boundary and Scott Avenue and View Street on the south boundary, with the west boundary north of Ward Street and the east boundary north of Ayers Avenue.

The climate of Tarrant County is humid subtropical with hot summers and mild winters, with an occasional front of extremely cold temperatures. The average high and low temperatures range from 37°F in January to 98°F in August. The lowest minimum recorded temperature is -1°F and the highest maximum 113°F. Annual precipitation also varies considerably, ranging from less than 20 inches to more than 50 inches, with an average of 33.7 inches (NOAA, 2001). The terrain consists of rolling hills ranging from 500 to 800 feet (150 to 240 m) in elevation, generally sloping to the east and southeast (Soil Conservation Service, 1981).

A large section of Tarrant County is located in the flood plains along the Trinity River. Much of the river has been channelized and contained between earthen levees for flood control purposes and no longer follows the original meandering route. These channelized areas are predominately manicured grasslands dominated by Bermuda grass (*Cynodon dactylon*). The flood plain contains Frio and Trinity soils, with a lesser amount of Arents, Ovan, Pulexas, and Whitesboro soils. Frio soils are located on the broad flood plains and consist of silty clay about 24 inches thick. Frio soils drain well and permeability is moderately slow. Trinity soils, located mostly along the West Fork, are dark gray clay to a depth of 63 inches and are also located on broad flood plains. This soil drains poorly and permeability is very slow. Most of the study area is within the 100 year floodplain, except small portions along the north boundary of the Riverside Oxbow section, the northwest area of the Gateway Park section along Beach street, and all of the Tandy Hills section. The Tandy Hills section contains the Aledo-Bolar-Sanger soil association which are shallow to moderately deep, gently sloping to moderately sloping clay and loamy soils (Soil Conservation Service, 1981). They drain well with moderate permeability.

Tarrant County is located in the Cross Timbers and Prairies ecological area of Texas (Gould, 1962). It contains three natural vegetational areas; a portion of the West Cross Timbers in the northwest, the Fort Worth Prairie through the central and southwest, and the East Cross Timbers on the eastside of the county (Diggs, Lipscomb, and O'Kennon, 1999). The West Fork of the Trinity River is located in the East Cross Timbers vegetational area. This area is predominately post oak (*Quercus stellata*) and blackjack oak (*Quercus marilandica*) located on "sandy, slightly acidic soils derived from the Cretaceous Woodbine and Trinity strata" and the "gravelly and rocky Pennsylvanian strata" (Diggs et al., 1999). Other woody vegetation found in the woodlands are red oak (*Quercus buckleyi*), cedar elm (*Ulmus crassifolia*), hackberry (*Celtis* sp.),

Figure 1. Riverside Oxbow Ecosystem Restoration Interim Feasibility Study



**Legend**  
○ HEP Sites  
— Project Boundary

pecan (*Carya illinoensis*), juniper (*Juniperus* sp.), cottonwood (*Populus deltoides*), green ash (*Fraxinus pennsylvanic*), box elder (*Acer negundo*), sycamore (*Platanus occidentalis*) and mesquite (*Prosopis glandulosa*). These woodlands also contain a wealth of forbs and grasses, such as hairy grama (*Bouteloua hirsuta*), side-oats grama (*Bouteloua curtipendula*), tall dropseed (*Sporobolous compositus*), switch grass (*Panicum virgatum*), Canada wild-rye (*Elymus canadensis*), and Texas winter grass (*Nassella leucotrica*) (Diggs et al., 1999).

The Prairies are open mid and tall grass communities with scattered trees and brush located on “tight calcareous clay soil developed from limestone” (Diggs et al., 1999). These areas were originally dominated by little bluestem (*Schizachyrium scoparius*), side-oats grama, Indian grass (*Sorghastrum nutans*), hairy grama, tall dropseed, and big bluestem (*Andropogon gerardii*). Most of these areas are used for cattle and horse grazing. Texas winter grass and silver bluestem (*Bothriochloa laguriudes* subsp. *torreyana*) occur in pastures that have been over grazed (Diggs et al., 1999).

Within these vegetational areas, Tarrant County contains several types of ecosystems, natural and anthropogenetically modified. These ecosystems include upland deciduous woodlands, riparian bottomland hardwoods, prairies (rangeland and natural grasslands), farmlands, shrublands, emergent wetlands, lakes, rivers and streams. A large portion of these ecosystems have been encroached by urbanization (buildings, yards, parkland, streets, railroads, and parking lots) from the City of Fort Worth and several adjacent communities.

The West Fork has a variety of aquatic habitats, i.e. riffles, runs, and pools. Several small low water dams have been constructed to hold water at specific points along the river. A study conducted in 1989 by the University of North Texas and the University of Texas at Dallas (Dickson, Waller, Kennedy, Arnold, Desmond, Dyer, Hall, Knight, Malas, Martinez, and Matzner, 1989) found 12 families and 46 species of fish in the Trinity River system. The three most prevalent fish species were sunfish (*Centrarchidae*, 11 species), minnows (*Cyprinidae*, 10 species), and catfish (*Ictaluridae*, 7 species). The four most abundant species were red shiners (*Notropis lutrensis*), mosquitofish, (*Gambusia affinis*), bullhead minnows (*Pimephales vigilax*), and longear sunfish (*Lepomis megalotis*).

## PROJECT ALTERNATIVES UNDER CONSIDERATION

The following are the restoration plans (Figure 2) being considered by the Corps:

### No Action Alternative

The “no action” alternative would mean that no lands would be acquired. There would be no reforestation, grassland restoration, wetland restoration, or related infrastructure construction.



# RIVERSIDE OXBOW

## NER PLAN

30 MAY 2002  
1:500  
1" = 50'-0"

N

REFRAIN WOODLANDS  
REFRAIN BUFFER  
NATIVE GRASSLANDS  
PROPOSED TREES  
SOFT PAVED ACCESS  
EXISTING TRAIL  
PARKING  
CHANNEL VEGETATION

NEW LAKE  
WETLAND  
EXISTING LAKE  
WET SOIL MOUNT  
EXISTENCE CITY PARK  
NATURE RESERVE  
LAKE VEGETATION  
ROAD

This topographic map illustrates the Riverside Oxbow area, featuring a prominent oxbow lake in the center. The map includes contour lines to show elevation, with labels such as 100, 120, 140, 160, 180, 200, 220, 240, 260, 280, 300, 320, 340, 360, 380, 400, 420, 440, 460, 480, 500, 520, 540, 560, 580, 600, 620, 640, 660, 680, 700, 720, 740, 760, 780, 800, 820, 840, 860, 880, 900, 920, 940, 960, 980, 1000, 1020, 1040, 1060, 1080, 1100, 1120, 1140, 1160, 1180, 1200, 1220, 1240, 1260, 1280, 1300, 1320, 1340, 1360, 1380, 1400, 1420, 1440, 1460, 1480, 1500, 1520, 1540, 1560, 1580, 1600, 1620, 1640, 1660, 1680, 1700, 1720, 1740, 1760, 1780, 1800, 1820, 1840, 1860, 1880, 1900, 1920, 1940, 1960, 1980, 2000, 2020, 2040, 2060, 2080, 2100, 2120, 2140, 2160, 2180, 2200, 2220, 2240, 2260, 2280, 2300, 2320, 2340, 2360, 2380, 2400, 2420, 2440, 2460, 2480, 2500, 2520, 2540, 2560, 2580, 2600, 2620, 2640, 2660, 2680, 2700, 2720, 2740, 2760, 2780, 2800, 2820, 2840, 2860, 2880, 2900, 2920, 2940, 2960, 2980, 3000, 3020, 3040, 3060, 3080, 3100, 3120, 3140, 3160, 3180, 3200, 3220, 3240, 3260, 3280, 3300, 3320, 3340, 3360, 3380, 3400, 3420, 3440, 3460, 3480, 3500, 3520, 3540, 3560, 3580, 3600, 3620, 3640, 3660, 3680, 3700, 3720, 3740, 3760, 3780, 3800, 3820, 3840, 3860, 3880, 3900, 3920, 3940, 3960, 3980, 4000, 4020, 4040, 4060, 4080, 4100, 4120, 4140, 4160, 4180, 4200, 4220, 4240, 4260, 4280, 4300, 4320, 4340, 4360, 4380, 4400, 4420, 4440, 4460, 4480, 4500, 4520, 4540, 4560, 4580, 4600, 4620, 4640, 4660, 4680, 4700, 4720, 4740, 4760, 4780, 4800, 4820, 4840, 4860, 4880, 4900, 4920, 4940, 4960, 4980, 5000, 5020, 5040, 5060, 5080, 5100, 5120, 5140, 5160, 5180, 5200, 5220, 5240, 5260, 5280, 5300, 5320, 5340, 5360, 5380, 5400, 5420, 5440, 5460, 5480, 5500, 5520, 5540, 5560, 5580, 5600, 5620, 5640, 5660, 5680, 5700, 5720, 5740, 5760, 5780, 5800, 5820, 5840, 5860, 5880, 5900, 5920, 5940, 5960, 5980, 6000, 6020, 6040, 6060, 6080, 6100, 6120, 6140, 6160, 6180, 6200, 6220, 6240, 6260, 6280, 6300, 6320, 6340, 6360, 6380, 6400, 6420, 6440, 6460, 6480, 6500, 6520, 6540, 6560, 6580, 6600, 6620, 6640, 6660, 6680, 6700, 6720, 6740, 6760, 6780, 6800, 6820, 6840, 6860, 6880, 6900, 6920, 6940, 6960, 6980, 7000, 7020, 7040, 7060, 7080, 7100, 7120, 7140, 7160, 7180, 7200, 7220, 7240, 7260, 7280, 7300, 7320, 7340, 7360, 7380, 7400, 7420, 7440, 7460, 7480, 7500, 7520, 7540, 7560, 7580, 7600, 7620, 7640, 7660, 7680, 7700, 7720, 7740, 7760, 7780, 7800, 7820, 7840, 7860, 7880, 7900, 7920, 7940, 7960, 7980, 8000, 8020, 8040, 8060, 8080, 8100, 8120, 8140, 8160, 8180, 8200, 8220, 8240, 8260, 8280, 8300, 8320, 8340, 8360, 8380, 8400, 8420, 8440, 8460, 8480, 8500, 8520, 8540, 8560, 8580, 8600, 8620, 8640, 8660, 8680, 8700, 8720, 8740, 8760, 8780, 8800, 8820, 8840, 8860, 8880, 8900, 8920, 8940, 8960, 8980, 9000, 9020, 9040, 9060, 9080, 9100, 9120, 9140, 9160, 9180, 9200, 9220, 9240, 9260, 9280, 9300, 9320, 9340, 9360, 9380, 9400, 9420, 9440, 9460, 9480, 9500, 9520, 9540, 9560, 9580, 9600, 9620, 9640, 9660, 9680, 9700, 9720, 9740, 9760, 9780, 9800, 9820, 9840, 9860, 9880, 9900, 9920, 9940, 9960, 9980, 10000. The map also shows various roads, trails, and parking areas, as well as different types of vegetation and land use. A legend in the top right corner provides a key for the symbols used on the map.

### **Riverside Oxbow Action Alternatives**

- Acquisition of the property included within the Oxbow area.
- Restoring a contiguous riparian/bottomland hardwood corridor to a width of 150 feet on both sides of the oxbow, which includes improving approximately 26 acres of existing riparian hardwoods by planting containerized trees and shrubs, and reforestation of approximately 20 acres of open land.
- Restoring a bottomland hardwood buffer strip along I-30 from Riverside Drive to Sycamore Creek to help screen the noise from the freeway, and along both sides of Sycamore Creek from the freeway to the river channel, which includes improving approximately 7.8 acres of existing riparian hardwoods by planting containerized trees and shrubs, and reforestation of approximately 2 acres of open land.
- Restoring a 100 foot wide native grassland buffer strip from the edges of the riparian woodland corridor along both sides of the oxbow and along the west side of Sycamore Creek which would establish approximately 42.9 acres of native grassland.
- Restoring flows through the oxbow by removing the earthen plug between the oxbow and the river channel and constructing a bridge over the top of the opening to provide maintenance access.
- Restoring flows through the oxbow by placing a large culvert within the earthen plug to connect the oxbow and the river channel.
- Constructing a low in-stream earthen dam upstream of Beach Street within the oxbow to raise water levels.
- Constructing an in-stream earthen dam below Beach Street within the oxbow to raise water levels.
- Reconstructing the existing culvert at Beach Street to remove the constriction to flow and to provide a safe corridor for animal movement along the riparian zone.
- Establishing approximately 107.9 acres of mixed native grasses and tree mottes.
- Constructing a wetland complex that would include approximately 7.2 acres of emergent wetlands and a deeper water pond approximately 5.1 acres in size. Constructing a narrow “natural” outflow channel, a water control structure, and a water pumping station to provide a reliable water source, and establishing emergent wetland vegetation on 7.2 acres.

### **Gateway Park Action Alternatives**

- Acquisition of the property included within the area.
- Enhancing an existing wetland complex by re-contouring the cells to provide for more water depth gradients, establishing emergent wetland and forest pond vegetation on 29 acres, a water control structure, and a water pumping station to provide a reliable water source.
- Establishing approximately 142.3 acres of mixed native grasses and tree mottes.
- Restoring 11.2 acres of riparian corridor which includes improving approximately 9.7 acres of existing riparian woodlands and reforestation of 1.5 acres of open land.

- Restoring a 100 foot wide native grassland buffer strip from the edges of the riparian woodland corridor on 8.3 acres.
- Restoring a bottomland hardwood buffer strip along I-30 from Beach Street to the area across from the existing canoe launch in Gateway Park to help screen the noise from the freeway and a riparian corridor along the northern edge of the oxbow from Beach Street to the area across from the existing canoe launch, which includes improving approximately 15.7 acres of existing riparian hardwoods by planting containerized trees and shrubs, and reforestation of approximately 13.3 acres of open land.
- Restoring a contiguous riparian/bottomland hardwood corridor to a width of 150 feet from the existing canoe launch to East 1<sup>st</sup> Street on both sides of the river and restore two adjacent existing bottomland hardwood tracts for a total of 104.5 acres, which includes improving approximately 93.5 acres of existing riparian hardwoods by planting containerized trees and shrubs, and reforestation of approximately 11 acres of open land.
- Constructing a wetland complex that would include approximately 10 acres of emergent wetlands, a deeper water pond approximately 12.8 acres in size, and a 4 acre wet soil management area, along with two water control structures, and a water pumping station to provide a reliable water source, and establishing emergent wetland vegetation on 17.6 acres.

#### **Tandy Hills Action Alternatives**

- Acquisition of the property included within the area.
- Constructing a perimeter fence of approximately 14,700 linear feet.
- Removal of concrete foundation and asphalt parking lot from an old commercial business site.
- Backfill for slope repairs.
- Placing topsoil and planting of native grasses and forbs in 4 acres.
- Manual clearing of invading exotic species from bottomland hardwood understory and Eastern red cedars on prairie uplands.
- Planting of native understory vegetation, protecting creek beds, etc.

### **HABITAT EVALUATION METHODS**

Service personnel, with participation from the Corps and the TPWD, conducted habitat assessments within of the study area in April 2001, and February and April 2002. Using Geographic Information System (GIS) and Global Positioning System (GPS) technology, habitat cover types were identified. The GPS units were utilized to acquire site specific habitat characteristics through ground truthing. Information was collected to assess the existing habitat conditions of the four dominant habitat cover-types described below and compare them with optimum conditions:

- 1) **Bottomland Riparian Woodlands** (241.4 acres) - This cover type is predominately

composed of mature pecan, oaks, and elms within the riparian corridors along the river, between the river and the ballfields in Gateway Park, along the Riverside Oxbow, and the small tributaries in the Tandy Hills section. This habitat provides food, cover, nesting habitat, and living space for forest dependant species. Large trees are important as nesting habitat for the fox squirrel (*Sciurus niger*) and red-tailed hawk (*Buteo jamaicensis*), and important escape cover for raccoons (*Procyon lotor*) and passerine birds. Brush piles and snags provide necessary food, cover, and shelter for the raccoon and passerine birds. Riparian forest habitats are essential in maintaining biodiversity and providing important wildlife travel corridors.

2) **Grasslands** (534.2 acres) - The grasslands are generally located in Gateway Park, the fallow farm fields in the oxbow section, the floodway zone, on the levees, and in the uplands of the Tandy Hills section. There are two types of grasslands in the study area, short grasslands and tall grasslands. The short grasslands are comprised of short native and introduced grasses and forbs, and sometimes scattered trees. These grasslands are routinely mowed. The tall grass fallow fields also contain a combination of native and introduced grass and forb species, but the composition is different than those in the short grass areas. These areas may have a few scattered trees and shrubs. Grasslands provide open space, a seed source for passerine birds, forage for the eastern cottontail (*Sylvilagus floridanus*), and cover for escape and nesting in brush piles and shrubs. Red-tailed hawks hunt for prey in open grasslands.

3) **Emergent Wetlands** (10.72 acres) - This cover type is comprised of rushes, sedges, wetland grasses, and aquatic plants which are associated with ponds and low areas along creeks, the river, lake-influenced areas, and seasonally, temporarily, and permanently flooded areas. Wetlands provide food and cover for fish, resident and migratory birds, small mammals, invertebrates, and the predators that feed on them. Emergent wetlands within the project areas are the Riverside Oxbow itself, the pond north of the Oxbow and west of Beach Street, the large wetland complex between Beach Street and the Gateway Park ballfields, the shallow remnant of Sycamore Creek before the river was channelized between the Riverside Oxbow and the river channel, an old oxbow of the river west of the ballfields and north of the old wastewater treatment plant, and portions of the old wastewater treatment plant drying beds.

4) **Upland Riparian Woodlands** (70 acres) - This habitat is the oak-hickory upland forest type dominated by post oak and live oak. Other tree species associated with this forest type include red oak, bur oak, cedar elm, green ash, sugar hackberry (*Celtis laevigata*), redbud (*Cercis* sp.), buckeye (*Aesculus* sp.), and mesquite. All of this habitat is located in the Tandy Hills portion of the study area. Upland forests provide food, cover, nesting habitat, and living space to forest dependant species. Large trees are important as nesting habitat for the fox squirrel and red-tailed hawk, and important escape cover for raccoons and passerine birds.



There are a few shrublands located in the project area, but data were not collected in this cover-type. This cover type is a dense early successional stage of the hardwood forest habitat discussed above. Shrubs are any woody plant less than 16.5 feet tall. In the project area, this cover-type is composed of scattered mesquites, young tree species (i.e., willows (*Salix sp.*), oaks, elms, and cedars), tall grasses, and various forbs. Shrublands provide cover and food sources for passerine birds, cottontails, and raccoons.

Thirteen survey sites were randomly selected within the different habitats in the project area. The survey site locations were recorded using a Garmin Personal Navigator GPS III Plus unit and are depicted in yellow on Figure 1. Appendix D lists the geographical locations of these sites. Habitat measurements were collected at five sites in the bottomland riparian woodlands (Sites #002, #003, #116, #118, and #119), three sites in emergent wetlands (Sites #113, #117 and #120), four sites in grassland habitats (Sites #111, #114, #115 and #121), and one site in upland riparian woodland (Site #112). These data were analyzed using the Service's *Habitat Evaluation Procedures* (HEP) (U.S. Fish and Wildlife Service, 1980) to describe the various existing habitats in the project area.

HEP requires the use of Habitat Suitability Index (HSI) models developed for indicator species that best represent groups of species that use the habitats in the project area. Nine wildlife indicator species were selected to represent the wildlife communities that use the four habitats surveyed. The raccoon (*Procyon lotor*), fox squirrel (*Sciurus niger*), Carolina chickadee (*Parus carolinensis*), barred owl (*Strix varia*), and the red-tailed hawk (*Buteo jamaicensis*) were selected to represent those species that use bottomland riparian woodlands. The raccoon, green heron (*Butorides striatus*), and wood duck (*Aix sponsa*) were selected to represent the wildlife community in emergent wetlands. The eastern meadowlark (*Sturnella magna*), eastern cottontail (*Sylvilagus floridanus*), and the red-tailed hawk were selected to represent the wildlife community in the grasslands and the tree savannas. The raccoon, fox squirrel, Carolina chickadee, barred owl, and red-tailed hawk represent upland woodland species.

The models for each of these species contain a list of structural habitat composition variables that were measured or estimated during the field surveys in the habitat they represent. The list of parameters for all the riparian/bottomland forest species was compiled for a total of sixteen parameters (Table 1). There were eleven different parameters measured for the emergent wetland habitat (Table 2) and eight parameters for the grassland habitat (Table 3). The variables were estimated within a tenth acre plot at each site.

The existing HSI for each indicator species was calculated using these variable measurements and the formulas contained in the indicator species models (Tables 4, 5, and 6). Each variable is expressed numerically as a Suitability Index (SI). The lowest SI of all the variables is considered the limiting factor, thus it is the HSI for the habitat that species is representing. The HSI value is expressed as a numeric function for each habitat, ranging from 0.0 to 1.0, where 0.0 represents no suitable habitat for an indicator species and 1.0 represents optimum conditions for the species. The number of Habitat Units (HU) in the project area for each species is calculated by



multiplying the area of available habitat by the mean HSI for each habitat.

All plant species and incidental wildlife sightings observed at each survey site on the survey dates were recorded and are listed in Appendices B and C. Appendix A contains photos of the different habitats in the project areas and in each compass direction from the center of some of the survey sites.

## DESCRIPTION OF EXISTING FISH AND WILDLIFE RESOURCES

The natural resources within the study area have been greatly impacted by past flood control projects, industrial and residential development, bridge construction, and agricultural activities. The quality of water is influenced by these modifications and various upland activities, i.e. water supply infrastructures, wastewater treatment plants, and urban and agricultural runoff. The west portion of the river in the study area runs through a channel that was constructed during a realignment project for flood control (page A-13), diverting water from the natural river segment known as the Riverside Oxbow (page A-14). The mouth of Sycamore Creek was displaced during this channelization. The oxbow is seasonally flooded with local rain runoff, drying up during certain months of the year and periods of drought.

The east portion of the project area (635 acres) is mainly within Gateway Park consisting of parklands of grass and scattered trees (282.3 acres), ballfields, roads and parking lots, an old wastewater treatment plant, riparian woodlands (215.07 acres), wetlands, and some open water. The old wastewater treatment plant is closed. There are several drying cells at the plant that hold water for short periods of time, but there is no active resource management being applied to the plant area.

The City owned Tandy Hills Park and private lands make up the southeast portion of the project (159 acres). This entire portion is considered uplands consisting of flat hill tops of grass, shrubs and few trees, and steep slopes descending into wooded stream corridors that intermittently flow into the West Fork of the Trinity River.

The project area is used by both resident and migratory species that are somewhat tolerant of human activity. Migratory waterfowl, shorebirds, and resident wood ducks, can be seen in the open water and emergent wetlands. The woodlands are most likely used by a variety of migratory and resident passerine, owl, and hawk species. Some common resident bird species that may be observed in the study area are sparrows, northern cardinal (*Cardinalis cardinalis*), blue jay (*Cyanocitta cristata*), common grackle (*Quiscalus quiscula*), scissor-tailed flycatcher (*Tyrannus forficatus*), belted kingfisher (*Ceryle alcyon*), American crow (*Corvus brachyrhynchos*), American kestrel (*Falco sparverius*), and red-tailed hawk. Mammal species that may utilize one or more habitat types in the study area include raccoon, striped skunk (*Mephitis mephitis*), opossum (*Didelphis virginiana*), coyote (*Canis latrans*), bobcat (*Lynx rufus*), eastern cottontail, fox squirrel, and small rodents. Common fish species that can be found in the river, streams, and

**Table 1. Structural habitat composition parameters estimated at each Riparian/Bottomland Hardwood survey site.**

	Survey sites					
	Gateway Park		Riverside Oxbow			Tandy Hills
Parameter	002	003	116	118	119	112
Percent tree canopy closure (%)	85	70	80	80	65	45
Percent tree canopy closure of mast producers $\geq 6$ in. dbh (%)	10	70	0	0	0	10
Percent canopy closure deciduous trees in stand (%)	85	70	80	80	65	45
Ave. dbh of overstory trees (in.)	11	22	15	26	4	8
Ave. height of overstory trees (ft.)	40	50	50	60	40	30
Overstory forest size class (A =<6"dbh, B =6-10"dbh, C =10-20"dbh, D =>20"dbh)	C	D	C	D	A	B
# of snags <19 in. dbh/acre (no/ac)	25	30	20	12	10	20
Percent shrub crown cover (%)	15	40	30	40	35	60
Number refuge sites per acre (no.)	3	3	45	20	15	15
Distance to water (ft.)	125	200	30	40	100	5
Water regime (A=Permanent, B=Semi-Permanent, C=None/Ephemeral)	A	B	A	A	A	B
# potential nest cavities/ acre	4	4	1.5	1.5	1.5	0
% water surface covered by logs, trees, or woody veg. within 1m	10	20	25	25	25	70
% herb. canopy cover in littoral zone	100	70	10	10	10	70
% water area <2m deep	100	100	100	100	100	100
Water current A)Still to slow (6 in/sec B)Mod. Slow (6 to 24 in/sec) C) Mod. fast (24 to 40 in/sec) D) Fast ( 40 in/sec)	A	A	A	A	A	B

**Table 2. Structural habitat composition parameters estimated at each Emergent Wetland survey site.**

	Survey sites		
	Gateway Park		Riverside Oxbow
Parameter	113	120	117
Distance to water (ft.)	0	300	0
Water regime (A=None/Ephemeral, B=Semi. Permanent, C= Permanent)	B	B	C
Water current (A=still-slow, B=mod-slow, C=mod-fast, D=fast)	A	B	A
Number refuge sites per acre (no.)	2	2	1
Percent water area < 10 in. deep (ave. summer cond.) (%)	10	0	100
Percent emergent herbaceous cover in littoral zone (%)	30	0	30
Percent water surface covered by logs, overhang veg., etc. (%)	1	NA	5
Aquatic substrate composition (A=muddy, B=sandy, C=rocky)	A	A	A
Distance to forested/shrub wetland (large trees)	300	600	100
Number potential nest cavities per acre	2	1	2
Percent water area < 6 feet deep (%)	100	NA	100

ponds are largemouth bass (*Micropterus salmoides*), channel catfish (*Ictalurus punctatus*), crappie (*Pomoxis sp.*), sunfish (*Lepomis sp.*), white bass (*Roccus chrysops*), carp (*Cyprinus carpio*), gar (*Lepisosteus sp.*), flathead catfish (*Pylodictis olivaris*), and various minnows and shiners. Several species of frogs and turtles may be found in the river and wetlands, while lizards and snakes can be found throughout the study area. A complete list of faunal species that occur in the project area is available on Page 3-18 of the *Programmatic Environmental Impact Statement (PEIS), Upper Trinity River Basin, Trinity River, Texas*, dated June 13, 2000.

**Table 3. Structural habitat composition parameters estimated at each Grassland survey site.**

	Survey sites			
	Gateway Park	Riverside Oxbow		Tandy Hills
Parameter	121	114	115	111
% herb. canopy cover	80	100	100	80
Ave. height of herb. canopy in summer	18	16	16	24
Avail. of weed, grass, grain seed A) Abundant B) Scattered C) Scarce	A	A	A	A
Composition of cover type A) Grass dominate B) Legume dominate C) Forb dominate	C	A	A	A
% shrub canopy cover	0	0	0	15
# refuge sites/ acre	0	4	2	4
% herb. canopy 6-24 in./ac.	0	100	100	50
# trees $\geq$ 12 in. dbh/ acre	0	0.5	0	2

## **Terrestrial Resources**

### **Riverside Oxbow**

**Grassland** - This grassland (171.9 acres), disturbed by years of cultivation, is located south of the oxbow and north of the mainstream of the West Fork, (pages A-1 through A-4). Data Sites #114 and #115 are located here (B-6 and B-7). The field is harvested annually for hay.

Johnsongrass (*Sorghum halepense*), Canada wild rye, and Bermuda grass dominate the field with patches of native grasses including little bluestem, big bluestem, switchgrass, side-oats grama, Indian grass, and a few scattered pecan trees. The overall HSI value for this habitat is 0.76, which is considered good habitat, with 131.8 habitat units (Table 4). It could be improved with the presence of shrubs and if the average height of the herbaceous cover in the summer were increased to 6 to 12 inches to provide cover.

**Riparian Woodlands** - There are approximately 33.8 acres of dense bottomland woodlands in the Oxbow section of the project area. Although the river has been diverted, the Riverside oxbow is still considered part of the riparian corridor. Data sites #116, #118, and #119 (pages A-4 through 6, A-8 through A-11, B-8, B-10, and B-11 ) are located in the oxbow woodlands. The

predominate tree species are sugar hackberry, cedar elm, American elm (*Ulmus americana*), cottonwood, red mulberry (*Morus rubra*), and pecan. The dense understory of the oxbow woodland includes, but is not limited to, common greenbrier (*Smilax rotundifolia*), poison ivy (*Rhus toxicodendron*), Virginia creeper (*Parthenocissus quinquefolia*), giant ragweed (*Ambrosia trifida*), and immature hardwood tree species listed above.

This riparian corridor is very fragmented and narrow with some sections only approximately 30 feet wide. A corridor this narrow is considered to be all edge, making poor nesting habitat for certain woodland birds susceptible to nest predation, but it contains large trees suitable for hawk nesting. The limiting factor for the riparian habitat in this section is the lack of large mast producing trees. Overall, this habitat is considered average riparian woodland habitat with an HSI value of 0.6, comprising 20.9 HUs (Table 4).

**Table 4. Habitat Suitability Index Values and Habitat Units for the Existing Conditions in the Riverside Oxbow for Each Indicator Species.**

Species	Grassland/Old Pasture (171.9 acres)		Riparian Woodland (33.8 acres)		Emergent Wetland (2.2 acres)	
	HSI	HU	HSI	HU	HSI	HU
Barred Owl			0.85	28.7		
Carolina Chickadee			0.8	27.0		
Fox Squirrel			0.0	0.0		
Eastern Meadowlark	0.67	115.2				
Wood Duck			0.28	9.5	0.0	0.0
Raccoon			0.78	26.4	0.15	0.33
Green Heron					0.41	0.9
Eastern Cottontail	0.63	108.3				
Red-tailed Hawk	1.0	171.9	1.0	33.8		
<b>Average</b>	0.76	131.8	0.62	20.9	0.19	0.41

## Gateway Park

**Grasslands** - The 282.3 acres of grasslands in the Gateway Park area are located throughout the

park; east of Beach Street between the river channel and I-35, between the large wetland complex and the ballfields (Data Site #121), between the south park road and the old wastewater treatment plant, north of the ballfields, and along the roadsides.

The Gateway Park grasslands are dominated by forbs with Johnsongrass and Bermuda grass (page B-13). However, the grasslands are considered poor habitat with only an HSI of 0.1 (Table 5), providing only 28.23 HUs, because they are kept mowed to about 6 inches tall. These grasslands contain no shrubs or brush piles for prey cover, except along the edges of the woodlands. Also, there is a great amount of human disturbance which could disrupt hawk nesting.

**Table 5. Habitat Suitability Index Values and Habitat Units for the Existing Conditions in Gateway Park for Each Indicator Species.**

Species	Grassland/Old Pasture ( 282.3 acres)		Riparian ( 215.07 acres)		Emergent Wetland ( 8.52 acres)	
	HSI	HU	HSI	HU	HSI	HU
Barred Owl			0.84	180.66		
Carolina Chickadee			0.82	176.36		
Fox Squirrel			0.53	113.99		
Eastern Meadowlark	0.1	28.23				
Wood Duck			0.36	77.4	0.00	0.00
Raccoon			0.79	169.90	0.60	5.11
Green Heron					0.40	3.41
Eastern Cottontail	0.0	0.0				
Red-tailed Hawk	0.2	56.46	1.00	215.07		
<b>Average</b>	0.1	28.23	0.72	155.6	.33	2.8

**Riparian Woodlands** - There are 211.27 acres of riparian woodlands in Gateway Park, located along both sides of the river and the east end of the old oxbow, around the banks of the wetlands north of the south park entrance road and the old drying beds, and north and east of the ball fields. The predominate tree species are pecan, sugar hackberry, cedar elm, box elder, American elm, and Chinaberry (*Melia azedarach*) (B-1 and B-2). The understory shrubs are predominantly box elder, privet (*Ligustrum sp.*), and coral-berry (*Symphoricarpos orbiculatus*). The understory

forbs include, but are not limited to, common greenbrier, poison ivy, Virginia creeper, ragweed, Japanese honeysuckle (*Lonicera japonica*), and pokeweed (*Phytolacca americana*). These woodlands are considered very good habitat for riparian wildlife with an overall HSI of 0.72 (Table 5). The limiting factor for this habitat is the lack of emergent herbaceous canopy cover in the littoral zone and there are few overhanging logs and limbs in the river for waterfowl and wading bird use. The edges of the river are too steep and the current is too fast for broods. This riparian woodland lacks large mast producing trees in some areas and the tree canopy cover is too closed for some forest species.

## **Tandy Hills**

**Grasslands** - The 90 acres of grasslands in Tandy Hills may be the only remnants of the original Fort Worth Prairie within the city limits (pages A-15 through A-18). Many of the original plant species are still present, although it is being invaded by red cedar (*Juniperus virginiana*) and non-native privet (*Forestiera sp.*). The grassland includes little bluestem, Indian grass, big bluestem, switchgrass, sideoats grama, tall dropseed, slim tridens (*Tridens muticus*), white tridens (*tridens albescens*), Texas winter grass, three-awn (*Aristida sp.*), buffalograss (*Buchloe dactyloides*), blue grama (*Bouteloua gracilis*) and hairy grama, and a wide variety of forbs (Clark, 1989). Data Site #111 contained short three-awn and switchgrass with scattered trees and shrubs (page B-3). The average height of herbaceous canopy is too tall for ground feeding birds, such as the meadowlark. There are few trees in the Tandy Hills large enough for hawk nesting; however, the grasslands are considered good habitat for hawk prey species. Overall, it is very good grassland habitat with an overall HSI value of 0.80, with 72 HUs (Table 6).

**Riparian Woodlands** - Tandy Hills is completely out of the 100-year floodplain of the Trinity River, therefore, the 60 acres of riparian woodlands in this area are considered upland woodlands (pages A-16 and A-17). Many of the drainages in this area are dry most of the year. The National Wetlands Inventory (NWI) (Cowardin, Carter, and Golet, 1992) depicts the stream located in the east portion of Tandy Hills as a temporarily flooded palustrine wetland. Although these riparian corridors are out of the floodplain, they are important for cover and wildlife movement within the Tandy area itself, and to and from the Gateway Park area. The riparian corridors provide connectivity between two diverse ecosystems, upland and bottomland. They increase the value of the wildlife habitats throughout the study area by merely increasing the amount of wildlife habitat in close proximity, creating a larger, more complex ecosystem and higher biodiversity. It also functions as a filter to protect the river from pollution and siltation from erosion caused by human activities in this high gradient topography. Data Site #112 is located in this area (page B-4). The predominant tree species are red oak, cedar elm, green ash, and mesquite with a few cottonwood. The understory shrubs are coralberry, cedar elm, mesquite, and an invading introduced privet. Other woody species known to occur in the lower areas are pecan, American elm, bur oak, and sugar hackberry (Clark, 1989).

The Tandy Hills riparian areas are fair habitat with an overall HSI value of 0.43 and 25.8 HUs (Table 6). The limiting factors were the average tree height was only about 30 feet, the average

**Table 6. Habitat Suitability Index Values and Habitat Units for the Existing Conditions in the Tandy Hills for Each Indicator Species.**

Species	Grassland/Old Pasture (90 acres)		Upland Riparian Forest (60 acres)	
	HSI	HU	HSI	HU
Barred Owl			0.41	24.6
Carolina Chickadee			0.65	39.0
Fox Squirrel			0.37	22.2
Eastern Meadowlark	0.63	56.7		
Wood Duck			0.0	0.0
Raccoon			0.6	36.0
Eastern Cottontail	1.0	90.0		
Red-tailed Hawk	0.78	70.2	0.55	33.0
<b>Average</b>	<b>0.80</b>	<b>72.0</b>	<b>0.43</b>	<b>25.8</b>

dbh was small, and the tree canopy closure was too open. There are not enough large mast producing trees and the percent shrub cover is too high.

### **Aquatic Resources**

Aquatic habitats within the project area include the main channel of the West Fork, Riverside oxbow, and a few scattered emergent wetlands. Palustrine emergent wetlands include narrow strips along the waters edge of the river and the oxbow, which are dominated by herbaceous hydrophytes most of the growing season. The tree and shrub species in all the wetlands are the same species found in the riparian woodland areas discussed above. The emergent wetlands are the only aquatic habitats included in this assessment.

### **Riverside Oxbow**

Due to the man-made levee separating the old Riverside oxbow from the excavated main channel of the river, the oxbow no longer contains periodically or continuously flowing water. Water in large segments of the oxbow is considered semi-permanent with the potential to dry up in the summer. Therefore, the NWI (Cowardin, Carter, and Golet, 1992) no longer considers it as riverine habitat. The oxbow is a semi-permanently flooded palustrine system with an unconsolidated bottom, dominated by deciduous trees, shrubs, persistent emergents, emergent



mosses or lichens. The oxbow contains a high number of potential nest cavity trees.

There is a shallow depression in the middle of the large grassland between the oxbow and the main channel of the river that was a section of Sycamore Creek before the river was channelized. Data Site #117 is located in this wetland (pages A-6, A-7, and B-9). This wetland is defined by the NWI as semi-permanently flooded palustrine. However, field visits have determined that this area has been cultivated and silted-in for a while. It still produces hydrophytic plants during wet periods, such as water-primrose (*Ludwigia peploides*) and curly dock (*Rumex crispus*). A few pecan and black willow (*Salix nigra*) trees line the shoreline. The overall HSI value for this wetland is 0.19, which is considered poor habitat (Table 1), because it is ephemeral, there are no logs or tree limbs hanging over the water, and there are few refuge sites available.

The pond on Beach Street is a permanently flooded palustrine system (approximately 2 acres) dominated by vascular plants on and under the surface for most of the growing season in most years. The origin of this pond is not known, but it may have been excavated for some unknown reason. Waterfowl and egrets have been seen using this pond. The fisheries resources of this pond have not been evaluated.

A new wetland area was created in 2001 between the main river channel and I-30 just east of the Riverside Drive bridge when the banks of the river channel were laid back as part of the Beach Street low water dam construction project (pages A-12 & 13). Aquatic vegetation has not had time to establish in this wetland. Grass has been planted around the edge and is kept mowed to about 6 inches tall. The low water dam created 56.6 acres of open water in the main channel of the river which may provide a resting sites for migratory birds and fish habitat. The banks of the impoundment will be managed to remain open, with no overhanging vegetation to provide food or cover. A few wading birds currently use the low water dam site for feeding.

There are two, approximately 4 acre seasonally flooded, upland forested wetlands north of the oxbow and south of Lawnwood Avenue behind homes and businesses. The first one is east of Denair Street and the second one is east of De Costa Street. The water source for these wetlands is probably runoff from the surrounding areas.

### **Gateway Park**

The large excavated wetland (approximately 20 acres), between Beach Street and the ballfields in Gateway Park, is divided into three parts. The NWI defines most of it as semi-permanent palustrine, which means surface water is present throughout the growing season in most years. A small seasonally flooded section in the middle of this wetland was covered with shrubs. The largest portion of this wetland complex was surrounded by black willow, cottonwood, hackberry, and cedar elm trees. The shrub layer contained red oak, buttonbush (*Diodia virginiana*), privet, *Baccharis*, Texas redbud (*Cercis canadensis* var. *texensis*), winged elm (*Ulmus alata*), coralberry, greenbrier, southern dewberry (*Rubus trivialis*), and *Sesbania*. The ground cover is Johnsongrass. Gadwalls (*Anus strepera*) and mallards (*Anas platyrhynchos*) were seen using the

site during the survey dates. The smaller eastern section of the wetland complex was surrounded by large cottonwoods, black willows, hackberry, Texas redbud, and American elm. The shrub layer contained red cedar, willow, Baccharis, winged elm, pecan, privet, red oak, grapevine, honeysuckle, greenbrier, and southern dewberry. There were clumps of common reed (*Phragmites australis*) along the edge. Red-wing blackbirds (*Agelaius phoeniceus*), northern cardinals, great blue herons (*Ardea herodias*), and downy woodpecker (*Picoides pubescens*) were observed during the field surveys. A HEP assessment was not conducted for this wetland.

The NWI depicts the old wastewater treatment plant drying beds as excavated semi-permanent, artificially flooded palustrine wetlands with an unconsolidated bottom. However, since the plant has closed, they are no longer managed to hold water. They may hold water temporarily after rainfall. The most northern cell contained approximately 11 acres of water when the assessment was conducted on April 10, 2002. Data Site # 120 (page 3 and B-12) is located at this pond. The waters edge was covered in sedges, ragweed, Johnson grass, and dock. About 20 percent of the edge was covered in black willows. Much of the edge had been mowed recently. The woods surrounding the pond contained cottonwood, bur oak, green ash, cedar elm, pecan, and Chinaberry trees. The shrub layer contained willow, mesquite, and hackberry. Blue-winged teal (*Anas clypeata*), mallards, yellowlegs (*Tringa sp.*), and dowitchers (*Limnodromus scolopaceus*) were feeding at the site. Data Site #113 is located in the small drying cell on the south east corner of the plant. This site was dry during the assessment. The bottom was covered in ragweed, with scattered box elder and red mulberry trees (15 - 30 feet tall) and box elder and hackberry shrubs (page B-5). There was one 50 foot tall hackberry in the bottom area. Forty to fifty foot tall trees lined the edge of the cell. Hedge parsley (*Torilis arvensis*) grew thick along the edges and scattered in the bottom.

The overall HSI for these drying beds is 0.33 with only an average of 2.8 habitat units available (Table 5). These cells are considered poor habitat for wetland dependant species because there is not a consistent water source to provide food and cover throughout the summer.

The NWI map indicates that there is a permanently flooded excavated wetland area on private land in the project area north of the park just south of Lawnwood Avenue. This area has been greatly impacted by human activities. An assessment was not conducted at this wetland.

There are several emergent wetlands, located north of the ballfields just west of the north park entrance. There are also several temporarily flooded forested areas along the main river channel, one emergent, one seasonally flooded scrub/shrub, and two small temporarily flooded forested wetlands. The HEP was not conducted at these wetlands.

### **Tandy Hills**

The NWI map indicates that the Tandy Hills have very few wetlands. There is a small man-made impoundment in the east portion just north of the end of Harwood Street, but it was not included in the assessment.

## **Endangered Species**

The only federally listed threatened or endangered species known to occur in Tarrant County are the endangered whooping crane (*Grus americana*), endangered interior least tern (*Sterna antillarum*), threatened bald eagle (*Haliaeetus leucocephalus*), and the proposed threatened mountain plover (*Charadrius melodus*).

Endangered whooping cranes may be encountered in any county in north central Texas during migration, including Tarrant. Autumn migration normally begins in mid-September, with most birds arriving on the wintering grounds at Aransas National Wildlife Refuge between late October and mid-November. Spring migration occurs during March and April. Whooping cranes prefer isolated areas away from human activity for feeding and roosting, with vegetated wetlands and wetlands adjacent to cropland being utilized along the migration route. Foods consumed usually include frogs, fish, plant tubers, crayfish, insects, and waste grains in harvested fields. Due to the lack of suitable habitat and its urbanized nature, it is unlikely that this species would utilize any of the study areas.

The endangered interior least tern nests in colonies on bare to sparsely vegetated sandbars along rivers and streams in Texas, from May through August. Nesting areas are ephemeral, changing as sandbars form, move and become vegetated. Because natural nesting sites have become sparse, interior least terns have nested in atypical/non-natural areas which provide similar habitat requirements. For example, one colony has been nesting for several years at the Southside Wastewater Treatment Plant in Dallas. Non-natural nesting sites include sandpits, exposed areas near reservoirs, gravel levee roads, dredged islands, gravel rooftops, and dike-fields. In recent years, terns have been utilizing artificial habitat more frequently within the Dallas area with small colonies being established in highly developed areas. Ground disturbance related to construction activities near the Trinity River may incidentally create areas that are attractive to least terns for use as potential nesting sites. Due to the presence of the gravel operation along Beach Street, the wetland complex, and the Trinity River within close proximity, it is likely that nesting least terns could be using the project area.

Bald eagles are considered winter and possible spring residents of Tarrant County. Bald eagles nest, roost, and perch in tall trees near water and feed primarily on fish and waterfowl. Winter habitat includes reservoirs, lakes, playas, rivers, and marshes. The project areas and/or adjacent lands contain large trees suitable for perching and nesting by bald eagles. Nesting bald eagles have been documented at Lake Worth. Most wintering bald eagles migrate north February through March; however, nesting eagles either stay throughout the entire year or migrate late in the summer. Due to the development and disturbance in the study areas, it is also unlikely that these areas would be used by eagles.

## FUTURE WITHOUT THE PROJECT

If the proposed plan or some other habitat restoration and preservation action is not implemented, the project area will still change with time depending on natural and human influences. With the “no action” alternative, existing habitats would probably be degraded as development continues in and around the project area. Without restoration and effective management, the only habitats that would remain would most likely be in the City parks. Water quality and biodiversity would be deleteriously impacted by human activities upstream, in the project area, and surrounding lands. Habitat loss due to uncontrolled public use and exotic plant invasion would continue in the Tandy Hills. The land proposed to be acquired would most likely be sold to private industry and developed. Estimated average annual habitat units (AAHU) for the project area per habitat without the proposed project in 10 years and 50 years is shown on Table 7.

**Table 7. Average Annual Habitat Units without Project.**

Area	Grassland			Riparian Woodland			Wetland			Totals		
	2002	Year 10	Year 50	2002	Year 10	Year 50	2002	Year 10	Year 50	2002	Year 10	Year 50
Riverside Oxbow	131.8	103.0	17.0	20.9	13.3	15.2	0.4	0.38	0.0	153.1	116.7	32.2
Gateway Park	28.2	28.2	16.9	155.6	150.0	116.2	2.8	2.6	2	186.6	180.8	135.1
Tandy Hills	72.0	63	36.0	25.8	25.2	24.0	NA	NA	NA	97.8	88.2	60.0
Totals	232.0	194.2	69.9	202.3	188.5	155.4	3.2	2.98	2	437.5	385.7	227.3

### Terrestrial Resources

The grassland south of the oxbow channel and west of the ballfields would probably continue to be maintained as cultivated hay fields in the near future. Habitat values in these fields would remain the same as they are today. The land may eventually be purchased by the City of Fort Worth and converted into ballfields and parkland. The grass would most likely be maintained at a height of 6 inches as the grasses in the park are currently. This type of grassland provides very little wildlife habitat and the HSI values for the indicator species would be at a minimum.

Some of the grasslands may not be maintained and slowly be invaded by shrubs until they convert into shrubland and eventually into woodland. As the invading trees and shrubs become too dense, it would no longer be suitable grassland habitat. However, the invading shrubs would provide more cover for prey species, until they become too dense. Shrubland, and later woodland, wildlife species would eventually immigrate into this area. There is the possibility that these areas could be developed, in which case they would provide no habitat values.

As shrublands become thicker and eventually develop into forest lands, habitat values for woodland species would increase. As the shrubland becomes very dense, blocking out the sunlight within the first 10 years, the amount of herbaceous vegetation that provides forage for prey species will decrease. The shrubland habitat value would decrease for raptors, but then it would increase later as the habitat moves into a more mature forest.

Without the proposed project, the woodlands in the park would probably remain as they are today, providing good habitat. The City may purchase the land proposed for acquisition, but restoration measures most likely would not be completed. The riparian corridors would remain fragmented and narrow, providing the limited habitat value it does today. Some mast producing trees in the Riverside Oxbow area would mature, improving food availability, and tree canopy cover would still be too closed. The woodlands outside of the park would be vulnerable to development, such as the riparian corridor on the north side of the oxbow, and woodland habitat dependant species would decline.

The woodlands in Tandy Hills and the adjacent private lands to the west will continue to be invaded by cedar and the introduced privet. Woodland habitat values would decrease as these shrubs close the open areas while not providing any food. The number of mast producing trees would remain low. Species associated with shrublands may increase. Both areas would continue to receive uncontrolled public use and the erosion problem would persist on exposed soils caused by off-road vehicles. The private lands proposed for acquisition would remain in private ownership and may eventually be developed in the future with all habitat values lost. All wildlife habitat values would decline.

### **Aquatic Resources**

Future upstream development could reroute and reduce the amount of runoff into the wetlands causing them to be dry for longer periods of time. It is possible that upstream development could also increase runoff velocity during flood conditions and blowout the wetlands or fill them with silt. Wetlands would slowly lose their habitat values. Wetland restoration opportunities may be lost permanently. The old oxbow itself would still be semi-permanent with the potential to dry up in the summer and would not provide the water needed for good wood duck brooding habitat. The Sycamore Creek remnant wetland south of the oxbow would most likely remain the same with little wildlife habitat value, but eventually it could silt in and/or be developed. If the small pond on Beach Street is not acquired and managed for wildlife use, development would eventually isolate it from other natural areas. Habitat values could decrease as water quality becomes degraded by contaminated runoff. The old wastewater treatment plant ponds would remain unproductive and will eventually become overgrown with trees and shrubs, providing habitat for species that utilize those habitats

## FUTURE WITH PROJECT

The proposed project is estimated to improve all habitats within the project area. Grasslands are estimated to increase by 313.5 AAHUs for a total of 383.4 AAHUs in 50 years (Table 8). Riparian woodlands are estimated to increase by 119.9 AAHUs for a total of 275.3 AAHUs in 50 years. Wetlands are estimated to increase by 61.5 AAHUs for a total of 63.5 AAHUs in 50 years. The overall estimated habitat gains with the project for the project area in 50 years is 494.9 AAHUs for a total of 722.2 AAHUs.

**Table 8. Average Annual Habitat Units with Project.**

Area	Grassland			Riparian Woodland			Wetland			Totals		
	2002	Year 10	Year 50	2002	Year 10	Year 50	2002	Year 10	Year 50	2002	Year 10	Year 50
Riverside Oxbow	131.8	138.8	138.8	20.9	39.0	55.8	0.4	12.0	12.0	153.1	189.8	206.6
Gateway Park	28.2	164.6	164.6	155.6	165.5	176.0	2.8	5.2	51.5	186.6	335.3	392.1
Tandy Hills	72.0	80.0	80.0	25.8	36.0	43.5	NA	NA	NA	97.8	116.0	123.5
Totals	232.0	383.4	383.4	202.3	240.5	275.3	3.2	17.2	63.5	437.5	641.1	722.2

### Terrestrial Resources

#### **Riverside Oxbow**

*Grassland* - The proposed project would decrease the amount of grasslands by about 21.1 acres for riparian woodland expansion and about 12 acres of grassland would be used to establish a wetland, but approximately 138.8 acres of grassland would be improved with native grasses. Due to proposed improvements, we assume that the HSI value for the remaining grasslands would increase to 1.0 from 0.76 in 4 to 5 years. Grassland habitat units would increase by 7 AAHU's to 138.8 AAHU's.

*Riparian Woodlands* - The project plans include increasing the width of the riparian woodland corridor to 150 feet. Twenty-two acres of grasslands would be planted with trees and 33.8 acres of existing riparian woodlands would be improved by tree planting to eventually create a total of 55.8 acres of riparian woodlands in the Riverside Oxbow area. Reforestation areas (grasslands) would slowly succeed into a good quality riparian woodland over a period of 50 years, possibly at a faster rate than if they were allowed to reforest naturally. The first year would show little change in habitat values. By the 10<sup>th</sup> year the trees in the reforested area would be shrub height, which could benefit wildlife species that utilize shrubland. Few of the planted hard mast producing trees would be mature. There would probably be little difference between any of the

reforestation alternatives. By year 50, the trees would have matured into large, hard mast producing trees providing food and cover for fox squirrels and barred owls. There should be plenty of tree cavities and snags for nesting wood ducks and raccoons and chickadees seeking shelter. If not thinned, the tree canopy cover may become too closed for optimum fox squirrel habitat, although some natural thinning may occur.

The proposed project would restore a water source for the oxbow by removing the earthen plug or uninstalling a culvert between the oxbow and the river channel. An in-stream dam would be installed in one of two locations down stream to raise the water level in the old oxbow. These actions would provide permanent water required for nesting and brood-rearing wood ducks. It is anticipated that this corridor would become optimum riparian woodland habitat within 50 years with a 1.0 HSI, yielding a total of 55.8 AAHUs.

### **Gateway Park**

*Grasslands* - The proposed project would produce more shrublands and woodlands, but less grasslands. There would be 256.5 acres of grasslands in the Gateway Park area after completion of the project. Approximately, 25.8 acres of existing grassland would be reforested to expand the woodland riparian corridor. Approximately, 150.6 acres of existing grasslands would be improved into a more productive native grassland. The remaining 80.1 acres would probably be maintained as mowed parkland with an HSI of 0.1 and 8 HUs. Assuming the improved grassland would be maintained as tall grass prairie, it would yield an HSI of 1.0 within 4 to 5 years. There would be a total of 164.6 AAHUs available for grassland species.

*Riparian Woodlands* - Approximately 118.9 acres of existing riparian woodland corridor would be improved by mast producing tree and shrub planting, and 25.8 acres of grassland would be converted into woodlands for a total of 144.7 acres of restored riparian woodlands. The other 92.37 acres of mature woodlands north of the ball fields and around the large existing wetland complex just west of Beach Street would remain the same. If any of the proposed reforestation plans were implemented, all of the proposed reforestation areas (grasslands) would probably slowly succeed into a good quality riparian woodland over a period of 50 years, but at a faster rate than if they reforested naturally. The first year would show little change from grasslands. By the 10<sup>th</sup> year the trees in the reforested area would be shrub height, which could benefit wildlife species that utilize shrubland. Few of the planted hard mast producing trees would be mature. There would probably be little difference between any of the alternatives by that time. By year 50, the trees would have matured into large, hard mast producing trees providing food and cover. More tree cavities and snags would be available for shelter. The tree canopy cover and shrub layer may become too dense for optimum habitat, although some natural thinning may occur. Unless the tree canopy is maintained to exceed 60 percent and the shrub layer maintained to no more than 30 percent, the quality of fox squirrel habitat will remain low. The proposed wetlands will be within 0.5 miles of the riparian woodlands, providing permanent still waters required by nesting and brood-rearing wood ducks. The estimated HSI value for the restored/improved woodlands in 50 years would be 0.91, with 109.29 HUs. The HSI value for

the remaining 92.37 existing acres of mature woodlands, which would not be improved, would remain as 0.72 in 50 years with 66.7 AAHUs. There would be approximately 176 riparian woodland HUs available in the Gateway Park area in 50 years.

## **Tandy Hills**

Actions proposed for the Tandy Hills area includes invasive shrub and erosion control, planting of native vegetation, and construction of a perimeter fence. The fence would exclude off-road/trail use which would allow vegetation to reestablish on disturbed and eroded areas. Enhancing these areas with additional native plants would expedite recovery and availability of wildlife food and cover. We assume that the HSI values of the grassland and woodland acres would increase in 50 years with active habitat management.

*Grasslands* - Four acres would be restored into native grasslands and forbs, which would increase the number of grassland acres to 94 acres. The proposed plan is to maintain these 94 acres as prairie grasslands up to 50 years. This should include discouraging excessive shrub growth, since true grasslands generally contain no more than 25 percent shrub cover. Trees would mature and grow larger. The meadowlark HSI value would not improve, because the average heights of the desired prairie grasses for the Tandy area are greater than the optimum height of herbaceous canopy for meadowlark habitat (12 inches). The estimated overall HSI value in year 50 is 0.85, with 80 AAHUs.

*Riparian woodlands* - In 10 to 50 years, there would still be 60 woodland acres in the Tandy Hills area if the grasslands are maintained. The proposed project includes clearing invading exotic species from the dense bottomland understory, providing some openings. Young mast producing trees and shrubs, existing and proposed to be planted, would mature in the areas where large producers are currently lacking. The shrub layer would still be too dense for optimum fox squirrel habitat. With time, snags would develop to improve habitat conditions for the chickadee and raccoon. The creek would still be intermittent and there still would not be any wood duck habitat. Because there is no wood duck habitat and none is being proposed, the wood duck is not included in the assessment for riparian woodland habitat in the Tandy Hills portion of the project area. The projected overall 50 year HSI value for this habitat, without the wood duck, is 0.73, with 43.5 AAHUs.

## **Aquatic Resources**

### **Riverside Oxbow**

Enlarging, planting, and providing a reliable water source for the old Sycamore Creek remnant/wetland would increase the number of wetland habitat units, benefitting all wetland species. The newly planted aquatic vegetation would probably be well established within one year, but habitat values for ducks and wading birds would still be low until the invertebrate



numbers increased. The woody debris and overhangs required for good wood duck, green heron, and raccoon habitat would not be established yet. Food availability would be greatly improved by the 10<sup>th</sup> year, but the woody debris and overhangs for perching and shelter would still be lacking. However, since the wetland is within 0.5 miles of the oxbow where there is plenty of potential nesting habitat, it would be considered optimum wood duck habitat. By the 50<sup>th</sup> year, it is assumed that woody debris and overhangs would be available along the edge of the wetland, yielding optimum habitat for all the wetland indicator species (1.0 HSI), providing 12 AAHUs (11.6 AAHU increase).

### **Gateway Park**

If the proposed project is implemented, another 43 acres of wetlands and 12.8 acres of deep water would be created, and the existing 8.52 acres of wetland would be enhanced. There would be a total of 51.5 acres of wetlands. Creating wetlands in the drying beds with a reliable water source would increase the number of wetland habitat units, benefitting all species that utilize wetlands. In the first year, the newly planted aquatic vegetation would probably be well established, but the new wetlands would have little value for ducks and wading birds until the invertebrate numbers increased. The woody debris and overhangs for good wood duck, green heron, and raccoon habitat would not be established yet. Conditions would be slightly improved by the 10<sup>th</sup> year, but the woody debris and overhangs would still be lacking. By the 50<sup>th</sup> year, the woody debris and overhangs would be available and the wetland HSI value for the Gateway Park area would be 1.0, yielding a total of 51.5 HUs.

### **Endangered Species**

The completion of any project features discussed in this report is not anticipated to affect any federally listed threatened or endangered species.

## **RECOMMENDATIONS**

The following recommendations should be implemented to restore natural habitats impacted by the construction and operation of Corps projects along the Fort Worth Floodway and to help ameliorate many of the secondary impacts from urban development within and adjacent to the project area.

1. The Johnsongrass/Bermuda grass dominated hay fields south of the oxbow and between Beach Street and the ballfields, and portions of the dikes, levees, and parklands should be reseeded and managed as native grasslands. We recommend planting native species appropriate for the soils. Little bluestem, big bluestem, Indian grass, eastern gamma grass, switch grass, Illinois bundle-flower (*Desmanthus illinoensis*), Maximilian sunflower (*Helianthus maximilian*), Engelmann's daisy (*Engelmannia peristeri*) are excellent forage and seed producing species to consider planting with scattered pecan and oak mottes. Uncontaminated, fresh top soil may need to be placed where excavation has

occurred along Beach Street.

2. Reduce mowing along dikes, levees, and parklands. A mowing schedule should be developed that promotes tall grass growth, but does not interfere with tall-grass nesting birds. The grassland should not be mowed until after July 15. Some shrubs should be allowed to grow to no more than 20 percent canopy cover.
3. Widen the riparian woodland corridors along the Riverside Oxbow and the main river channel to 330 feet (165 feet on each side of the river) where needed by planting native mast producing trees and shrubs. Native mast producing trees and shrubs, such as pecan, bur oak, red oak, black walnut (*Juglans nigra*), wild plum (*Prunus mexicana*), sumac (*Rhus sp.*), hawthorne (*Crataegus sp.*), and coral-berry, should be planted in the existing riparian woodland to improve canopy cover and food base. The thick understory may also need to be opened up around the young trees to provide space and sunlight. We recommend planting 70 percent woody stems, with no more than 25 percent soft mast producers. Shrubs should be planted at no more than 30 percent stems.
4. A year-round water source from the river for the Riverside Oxbow should be provided. The proposed low water dam on the oxbow downstream, close to the confluence with the river, would help to maintain water for a longer period of time. We further recommend that the oxbow channel not be disturbed (i.e. widening or deepening) in any attempt to improve habitat. The old oxbow wetland between the river and the ballfields could also be improved for wood duck habitat if a more reliable water source and a couple of wood duck boxes were provided.
5. We support creating a wetland complex at the old Sycamore Creek remnant wetland area between the Riverside Oxbow and the river (data site #117) and improving the large wetland complex between Beach Street and the ballfields in Gateway Park. The pool areas should be excavated to provide a deep water area with a gently sloping shoreline or shelves to allow various water depths. A reliable water source and water gates to allow water level manipulations would be required. We recommend maintaining a depth of less than 6 feet, preferably an average of 2 feet, year round. Most of the wetland should contain a depth of less than 1 foot most of the time. Plant locally available native aquatic plants, shrubs, and trees in and around the waters edge. We recommend the use of sedges (*Cyperus sp.*), softstem bulrush (*Scirpus validus*), water pennywort (*Hydrocotyle umbellata*), switchgrass, smartweeds (*Polygonum sp.*), and buttonbush. Wood duck boxes should be erected and brush and logs placed along the edge of the wetland.
6. We recommend improving the new wetland created in 2001 between the river and I-30 just east of Riverside Drive. Native aquatic plants should be established in and around the waters edge. The wetland should not be mowed unless it is to manage non-desirable species, i.e, exotics and shrubs.

7. The pond on Beach Street should be maintained, but provided a more reliable water source.
8. If the final laboratory results of the City of Fort Worth's hazardous materials testing shows the old wastewater treatment plant drying beds are free of contaminants, we support the plans to create a wetland complex. A portion of the beds should be excavated to provide a deep pool with a gently sloping shoreline or shelves to allow various water depths. A reliable water source should be provided to maintain a depth of less than 6 feet, preferably an average of 2 feet, year round. Native aquatic plants, shrubs, and trees should be established and maintained in and around the waters edge. Wood duck boxes should be erected and brush and logs placed along the edge of the wetland. Water control structures should provide complete drainage of the cells to allow non-desirable vegetation control by water manipulation or mowing. A moist soil/wetland management plan should be developed for this complex that will optimize migratory bird use.
9. Maintaining the Tandy Hills tall grassland habitat, possibly the largest relic of the original Fort Worth Prairie, should be one of the top priorities of this project. We recommend including this area in the project for protection and restoration of biodiversity and to improve water quality. The invading red cedar and exotic privet should be removed, and the riparian corridors maintained and restored where impacted. Erosion control techniques should be implemented in problem areas. We recommend that the old restaurant site be removed and restored, along with the other disturbed sites in Tandy Hills, to a natural habitat condition. For restoration efforts to be successful, vehicle access into Tandy Hills would need to be controlled by fencing.
10. Control bank erosion through use of biological engineering to the extent possible.
11. Develop a plan to eliminate the use of fertilizers, pesticides, and herbicides used on public lands.
12. Before any project actions begin, we recommend that proposed project areas near creeks, rivers, wetlands, or other water bodies be checked for the presence of tall trees which may serve as bald eagle roosting or nesting sites. If eagle roost or nest sites are discovered, this office should be contacted to discuss alternate construction plans.
13. We recommend surveying for interior least tern nesting within the excavation area on the private land along Beach Street during the breeding season prior to any construction or restoration work in that area. Our office would be willing to assist in developing the survey protocol for this effort.
14. A biological analysis should be conducted every few years using the same habitat evaluation techniques to monitor and quantify habitat impacts of the restoration sites. Such an analysis would provide good information for adaptive management and for

future habitat restoration planning projects.

15. If future assessments of the Tandy Hills grasslands are conducted, we recommend that the scissor-tailed flycatcher be used in place of the eastern meadowlark as an indicator species. Scissor-tailed flycatchers were observed feeding in the Tandy Hills grassland during one of our visits to the area. Habitat characteristics of this desirable tall grass prairie are not compatible with those required by the eastern meadowlark. The average height of the native prairie grasses in the Tandy area is 33 inches, and ranges between 25 and 41 inches, which is greater than the optimum height of herbaceous canopy for meadowlark habitat (12 inches). Scissor-tailed flycatchers prefer prairie-deciduous forest ecotones and open prairies with scattered large trees, such as the Tandy Hills grassland. They feed on flying insects and are not hindered by the height of the grass as would a ground feeder, such as a meadowlark. Using the meadowlark as an indicator in this habitat does not reflect the true HSI values of the Tandy Hill grasslands. The existing HSI value for the meadowlark was only 0.63, although this grassland is considered a very good example of the tall grassland we would like to maintain in the Tandy Hills area. The existing scissor-tailed flycatcher HSI value for this grassland is 1.0, which is optimum.

### **SUMMARY**

In summary, with the inclusion of these recommendations, we believe this reforestation and wetland creation/restoration project would greatly improve the diversity, quality and quantity of habitats within the project area, thus benefitting a variety of resident and migratory wildlife species.

## References

- Clark, L. Wayne. 1989. First Annual Report, Environmental Assessment of Tandy Hills Park. Unpublished. Fort Worth Nature Center and Refuge. 18pp.
- Cowardin, Lewis M., V. Carter, and F.C. Golet. 1992. Classification of Deepwater Habitats of the United States. Department of the Interior, Fish and Wildlife Service. FWS/OBS-79-31. 131 pp.
- Dickson, K.L., W.T. Waller, J.H. Kennedy, W.R. Arnold, W.P. Desmond, S.D. Dyer, J.F. Hall, J.T. Knight, Jr., D. Malas, M.L. Martinez, and S.L. Matzner. 1989. A water quality and ecological survey of the Trinity River, Vol. 1. Univ. of North Texas and the Univ. of Texas at Dallas. 339 pp.
- Diggs, G.M., Jr., B.L. Lipscomb, and R. J. O'Kennon. 1999. Shinnery & Mahler's illustrated flora of North Central Texas. Botanical Research Institute of Texas and Austin College. 1626 pp.
- Gould, F.W. 1962. Texas Plants - A checklist and ecological summary. Texas Agric. Exp. Sta. Misc. Publ. 585:1-112.
- NOAA. 2001. Dallas/Fort Worth Climate Overview.  
<http://www.srh.noaa.gov/fwd/CLIMO/dfw/annual/dnarrative.html>
- U.S. Army Corps of Engineers. 2000. Final programmatic environmental impact statement, Upper Trinity River Basin, Trinity River, Texas. U.S. Army Corps of Engineers, Fort Worth District.
- USDA, Soil Conservation Service. 1981. Soil survey of Tarrant County, Texas. National Cooperative Soil Survey. 218 pp.
- U.S. Fish and Wildlife Service. 1980. The habitat evaluation procedures. USDI Fish and Wildlife Service, Ecological Services Manual 102. 124 pp.

**Appendices**  
**for the Riverside Oxbow Ecosystem Restoration**  
**Interim Feasibility Study**  
**Existing Habitat Conditions Report**  
September 17, 2002

- A.    Photographs
- B.    HEP Sites Observation Sheets
- C.    Plant List
- D.    HEP Sites Geographical Positions



Site #114, Riverside Oxbow grassland, north view.



Site #114, Riverside Oxbow grassland, west view.



Site #114, Riverside Oxbow grassland, east view.



Site #114, Riverside Oxbow grassland, south view.





Site #115, Riverside Oxbow grassland, west view.



Site #115, Riverside Oxbow grassland, north view.



Site #115, Riverside Oxbow grassland, east view.



Site #116, Riparian at the Riverside Oxbow, east view.



Site #116, Riparian at the Riverside Oxbow, south view.



Site #116, Riparian at the Riverside Oxbow, north view.



Site #116, Riparian at the Riverside Oxbow, west view.



Site #117. Emergent Wetland at Riverside Oxbow, west view.





Site #117. Emergent Wetland at Riverside Oxbow, south view.



Site #117. Emergent Wetland at Riverside Oxbow, east view.



Site #118, West end of the old Riverside Oxbow riparian  
into where Sycamore Creek used to flow. East view.



Site #118, West end of the old Riverside Oxbow riparian  
into where Sycamore Creek used to flow. North view.



Site #118, West end of the old Riverside Oxbow riparian  
into where Sycamore Creek used to flow. South view.



Site #118, West end of the old Riverside Oxbow riparian  
into where Sycamore Creek used to flow. West view.





Site #119. Gateway Park, riparian north view.



Site #119. Gateway Park, riparian east view.

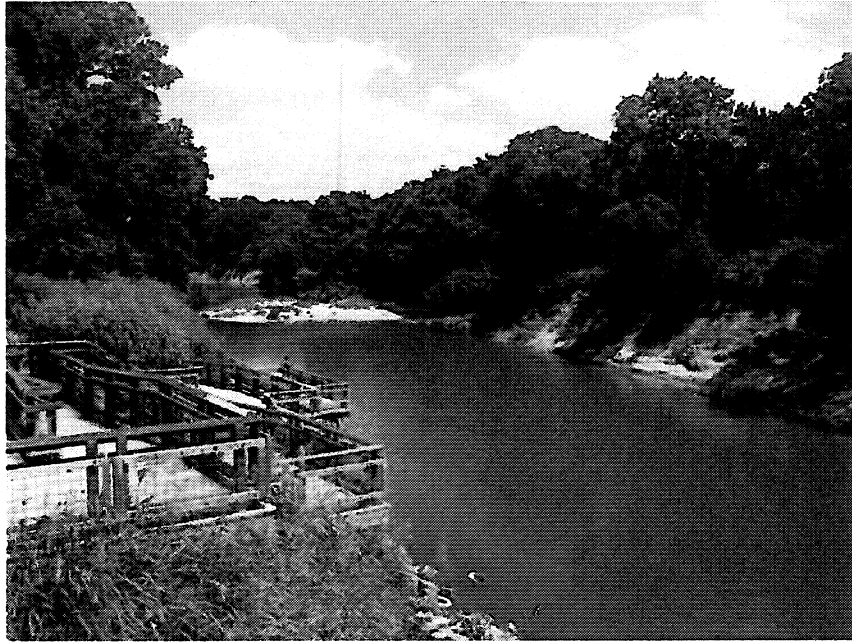




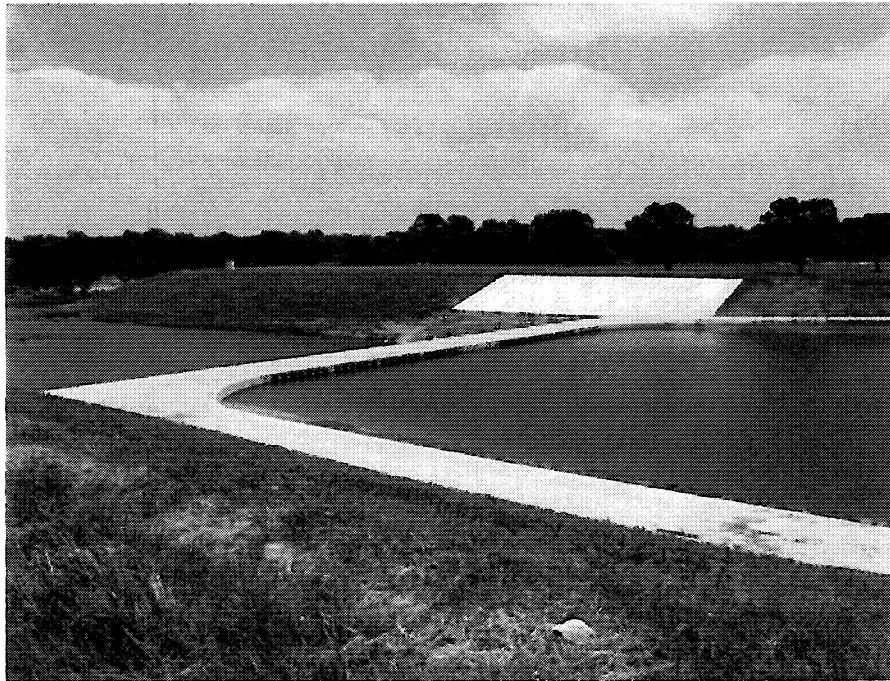
Site #119. Gateway Park, riparian west view.



Site #119. Gateway Park, riparian south view.



View of the West Fork of the Trinity River channel looking east from the canoe access ramp in Gateway Park.



The new low dam across the West Fork of the Trinity River near Beach Street.



View of the lake looking east toward the dam and the Beach Street bridge.



View of the lake looking west toward the Riverside Street bridge.



View of the original channel looking east from Beach Street.

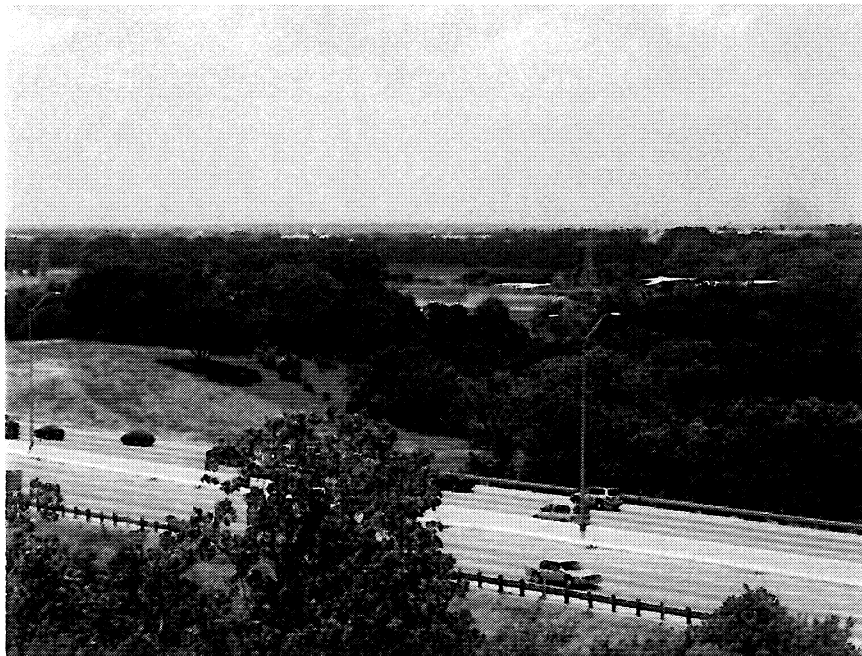


View of the old oxbow channel looking north from the levee near the west end.





The private land area south of I-30 between Beach Street and Ben Street looking west from the old restaurant.



View of Gateway Park from Ben Street across I-30.



Grassland and shrubs on hill top in Tandy Hills Park.



Stream bed of the main intermittent tributary of West Fork in Tandy Hills Park.



Trail in woodlands along the tributary stream in Tandy Hills Park.



View of grassland and topography in Tandy Hills Park.



View of Tandy Hills Park looking east.



## HEP Site Observations for the Riverside Oxbow Ecosystem Restoration Project

**Site:** Gateway Park

**Date:** 4/8/02

**GPS/ HEP sites #:** 002

**GPS/ Photo Sites #:**

**General Description and Observations:** Woodland with medium dense understory.

### Plant Species:

Tree:	Shrub:	Grass:	Vine or Forb:
sugar hackberry	box elder	wild rye	pokeweed
Pecan	privet		poison ivy
Chinaberry	coralberry		hedge parsey
box elder			wild onion
American elm			saw greenbrier
			giant ragweed
			common trumpet-creeper
			toothed spurge
			stinging nettle
			Viola sp.

**Wildlife Species Observed:**

## HEP Site Observations for the Riverside Oxbow Ecosystem Restoration Project

**Site:** Gateway Park

**Date:** 4/8/02

**GPS/ HEP sites #:** 003

**GPS/ Photo Sites #:**

**General Description and Observations:** Woodland with open understory

### Plant Species:

Tree:	Shrub:	Grass:	Vine or Forb:
pecan (dominate)	box elder	wild rye	poison ivy
cedar elm	privet		dead-nettle
hackberry	coralberry		wild celery (Umbelliferae sp.)
box elder			hedge parsely
American elm			dandelion
			greenbrier
			Japanese honeysuckle

### Wildlife Species Observed:

northern cardinals

## **HEP Site Observations for the Riverside Oxbow Ecosystem Restoration Project**

**Site:** Tandy Hills

**Date:** 4/10/02

**GPS/ HEP sites #:** 111

**GPS/ Photo Sites #:** Page A-15

**General Description and Observations:** Short grassland with scattered shrubs.

### **Plant Species:**

Tree:	Shrub:	Grass:	Vine or Forb:
post oak	mesquite	Aristida sp.	Aster sp.
live oak	cedar elm	Switchgrass	prickly pear

**Wildlife Species Observed:**

## HEP Site Observations for the Riverside Oxbow Ecosystem Restoration Project

**Site:** Tandy Hills

**Date:** 4/10/02

**GPS/ HEP sites #:** 112

**GPS/ Photo Sites #:** Page A-15

**General Description and Observations:** Upland woodland along small stream.

### Plant Species:

Tree:	Shrub:	Grass:	Vine or Forb:
red oak	privet ( <i>Forestiera</i> sp.)	Canada wild rye	hedge parsley
cedar elm	coralberry	unknown grass	locoweed
cottonwood	cedar elm		skunkbush
green ash	mesquite		
mesquite			

### Wildlife Species Observed:

## HEP Site Observations for the Riverside Oxbow Ecosystem Restoration Project

**Site:** Gateway Park

**Date:** 4/10/02

**GPS/ HEP sites #:** 113

**GPS/ Photo Sites #:**

**General Description and Observations:** Drying beds of the old waste water treatment plant. Covered by 100% giant ragweed in summer with scattered 15-30 ft. trees. Trees along the edge are 40-50 ft. tall. One hackberry in the bottom is about 50 ft. tall.

### Plant Species:

Tree:	Shrub:	Grass:	Vine or Forb:
sugar hackberry	box elder		hedge parsley along edge & some bottom
box elder	sugar hackberry		
red mulberry			
cottonwood (1)			

### Wildlife Species Observed:

red-tailed hawk

## HEP Site Observations for the Riverside Oxbow Ecosystem Restoration Project

**Site:** Riverside Oxbow

**Date:** 4/17/01

**GPS/ HEP sites #:** 114

**GPS/ Photo Sites #:** 114 (See photo pages A-1 & 2.)

**General Description and Observations:** Grassland between the old oxbow and the current main channel. This field has been agriculture land. There is a powerline the runs through it.

### Plant Species:

Tree:	Shrub:	Grass:	Vine or Forb:
		little bluestem	bindweed
		big bluestem	Indian mustard
		switchgrass	curly dock
		side-oats grama	locoweed
		Indian grass	
		Johnsongrass	

### Wildlife Species Observed:

willet (in the channel)  
common crow  
red-winged blackbird  
kingbird  
scissor-tailed flycatcher

## **HEP Site Observations for the Riverside Oxbow Ecosystem Restoration Project**

**Site:** Riverside Oxbow

**Date:** 4/17/01

**GPS/ HEP sites #:** 115

**GPS/ Photo Sites #:** 115 (See photo pages A-3 & 4.)

**General Description and Observations:** Grassland between the old oxbow and the wetland (site #117). This field has been agriculture land.

### **Plant Species:**

Tree:

Shrub:

Grass:

Vine or Forb:

little bluestem

bindweed

big bluestem

Indian mustard

switchgrass

curly dock

side-oats grama

locoweed

Indian grass

Johnsongrass

### **Wildlife Species Observed:**

## **HEP Site Observations for the Riverside Oxbow Ecosystem Restoration Project**

**Site:** Riverside Oxbow

**Date:** 4/17/01

**GPS/ HEP sites #:** 116

**GPS/ Photo Sites #:** 116 (See photo pages A-4 through 6.)

**General Description and Observations:** Riparian habitat on the old oxbow north of Sites #114 and #115. Very thick vegetation.

### **Plant Species:**

Tree:	Shrub:	Grass:	Vine or Forb:
sugar hackberry	box elder	Canada wildrye	saw greenbrier
American elm	chinaberry		poison ivy
cottonwood			
pecan			

### **Wildlife Species Observed:**



## HEP Site Observations for the Riverside Oxbow Ecosystem Restoration Project

**Site:** Riverside Oxbow

**Date:** 4/17/01

**GPS/ HEP sites #:** 117

**GPS/ Photo Sites #:** 117 (See photo pages A-6 and 7.)

**General Description and Observations:** Wetland site in the middle of the agricultural lands inside the bend of the oxbow. Great potential.

### Plant Species:

Tree:

black willow

pecan (along  
shoreline)

Shrub:

Grass:

grasses

Vine or Forb:

curly dock

Legume

water-primrose

### Wildlife Species Observed:

## **HEP Site Observations for the Riverside Oxbow Ecosystem Restoration Project**

**Site:** Riverside Oxbow

**Date:** 4/17/01

**GPS/ HEP sites #:** 118

**GPS/ Photo Sites #:** 118 (See photo pages A-8 and 9.)

**General Description and Observations:** Riparian habitat in the west end of the old Riverside Oxbow into where Sycamore Creek used to flow.

### **Plant Species:**

Tree:	Shrub:	Grass:	Vine or Forb:
cottonwood	box elder	Canada wildrye	saw greenbrier
sugar hackberry	chinaberry		poison ivy
			ragweed

### **Wildlife Species Observed:**

## HEP Site Observations for the Riverside Oxbow Ecosystem Restoration Project

**Site:** Riverside Oxbow / Gateway Park

**Date:** 4/17/01

**GPS/ HEP sites #:** 119

**GPS/ Photo Sites #:** 119 (See photo pages A -10 & 11.)

**General Description and Observations:** Riparian habitat on the east end of the old Riverside Oxbow.

### Plant Species:

Tree:	Shrub:	Grass:	Vine or Forb:
oak?	privet	Canada wildrye	poison ivy
sugar hackberry - dominate			woodbine
cedar elm - dominate			saw greenbrier
Bois d' Arc			stork's-bill
red mulberry			hedge-parsley
			wild onion

### Wildlife Species Observed:

## HEP Site Observations for the Riverside Oxbow Ecosystem Restoration Project

**Site:** Gateway Park

**Date:** 4/10/02

**GPS/ HEP sites #:** 120

**GPS/ Photo Sites #:**

**General Description and Observations:** Emergent wetland (~11 acres) ephemeral, except for 1 acre. Man-made impoundment surrounded by deciduous woods. Willows along about 20% of the edge. Looks like it has been mowed.

### Plant Species:

Tree:	Shrub:	Grass:	Vine or Forb:
cottonwood	black willow	Johnsongrass	curly dock
bur oak	mesquite		giant ragweed
Chinaberry	sugar hackberry		Cyperus sp.
green ash			
cedar elm			
pecan			

### Wildlife Species Observed:

blue-winged teal (~20)  
mallards (2)  
sandpipers (12)  
dowitcher

## **HEP Site Observations for the Riverside Oxbow Ecosystem Restoration Project**

**Site:** Gateway Park

**Date:** 2/23/02

**GPS/ HEP sites #:** 121

**GPS/ Photo Sites #:**

**General Description and Observations:** Grassland, mowed fields

### **Plant Species:**

Tree:

Shrub:

Grass:

Vine or Forb:

Johnsongrass

variety

Bermuda grass

### **Wildlife Species Observed:**

Red-tailed hawk

## HEP Site Observations for the Riverside Oxbow Ecosystem Restoration Project

**Site:** Gateway Park

**Date:** 2/23/02

**GPS/ HEP sites #:**

**GPS/ Photo Sites #:**

**General Description and Observations:** Wetland. Borrow pit west of the ballfields. Large trees surrounding the edge.

### Plant Species:

Tree:	Shrub:	Grass:	Vine or Forb:
cottonwood	red cedar	phragmites	Japanese honeysuckle
black willow	black willow		grapevine
sugar hackberry	Baccharis		greenbrier
Texas redbud	winged-elm		
American elm	pecan		
	privet		
	red oak		

### Wildlife Species Observed:

great blue heron  
red-winged blackbird  
northern cardinal  
downy or hairy woodpecker

## HEP Site Observations for the Riverside Oxbow Ecosystem Restoration Project

**Site:** Gateway Park

**Date:** 2/23/02

**GPS/ HEP sites #:**

**GPS/ Photo Sites #:**

**General Description and Observations:** Large pond west of the ballfields

### Plant Species:

Tree:	Shrub:	Grass:	Vine or Forb:
black willow	red oak	Johnsongrass	coralberry
cottonwood	buttonbush		bramble
sugar hackberry	privet		sesbania
cedar elm	Baccharis		greenbrier
	redbud		
	winged elm		

### Wildlife Species Observed:

gadwall (17)  
mallard (~30)  
eastern meadowlark

## Plant Species List for the Riverside Oxbow Ecosystem Restoration Project Area

Plants by Common Name in Alphabetical Order

### Common Name

### Scientific Name

#### Trees

American elm	<i>Ulmus americana</i>
Blackjack oak	<i>Quercus marilandica</i>
Black walnut	<i>Juglans nigra</i>
Black willow	<i>Salix nigra</i>
Bois d'arc	<i>Maclura pomifera</i>
Box elder	<i>Acer negundo</i>
Bur oak	<i>Quercus macrocarpa</i>
Cedar elm	<i>Ulmus crassifolia</i>
Chinaberry	<i>Melia azedarach</i>
Cottonwood	<i>Populus deltoides</i>
Green ash	<i>Fraxinus pennsylvanica</i>
Hackberry	<i>Celtis sp.</i>
Juniper	<i>Juniperus sp.</i>
Live oak	<i>Quercus virginiana</i>
Mesquite	<i>Prosopis grandulosa</i>
Pecan	<i>Carya illinoensis</i>
Post oak	<i>Quercus stellata</i>
Red mulberry	<i>Morus rubra</i>
Red oak	<i>Quercus shumardii</i>
Sugar hackberry	<i>Celtis laevigata</i>
Sycamore	<i>Platanus occidentalis</i>
Texas redbud	<i>Cercis canadensis var. texensis</i>

#### Shrubs

American elm	<i>Ulmus americana</i>
Baccharis	<i>Baccharis sp.</i>
Black willow	<i>Salix nigra</i>
Box elder	<i>Acer negundo</i>
Buckeye	<i>Aesculus sp.</i>
Buttonbush	<i>Diodia virginiana</i>
Cedar elm	<i>Ulmus crassifolia</i>
Common buttonbush	<i>Cephalanthus occidentalis</i>
Coral-berry	<i>Symphoricarpos orbiculatus</i>
Eastern red cedar	<i>Juniperus virginiana var. virginiana</i>
Hawthorne	<i>Crataegus sp.</i>



Mesquite  
 Post oak  
 Privet (native)  
 Privet (non-native)  
 Red cedar  
 Red oak  
 Skunkbush  
 Sugar hackberry  
 Sumac  
 Texas Redbud  
 Wild plum  
 Winged elm

*Prosopis grandulosa*  
*Quercus stellata*  
*Forestiera sp.*  
*Ligustrum sp.*  
*Juniperus virginiana*  
*Quercus shumardii*  
*Rhus trilobata*  
*Celtis laevigata*  
*Rhus sp.*  
*Cercis canadensis var. texensis*  
*Prunus mexicana*  
*Ulmus alata*

### **Grasses**

Bermuda grass  
 Big bluestem  
 Blue grama  
 Buffalograss  
 Canada wild-rye  
 Hairy grama  
 Indian grass  
 Johnsongrass  
 Little bluestem  
 Panicum  
 Paspalum  
 Phragmites  
 Side-oats grama  
 Silver bluestem  
  
 Slim tridens  
 Sugar hackberry  
 Switch grass  
 Tall dropseed  
 Texas winter grass  
 Three-awn  
 White tridens  
 Wildrye

*Cynodon dactylon*  
*Andropogon gerardii*  
*Bouteloua gracilis*  
*Buchloe dactyloides*  
*Elymus canadensis*  
*Bouteloua hirsuta*  
*Sorghastrum nutans*  
*Sorghum halepense*  
*Schizachyrium scoparius*  
*Panicum sp.*  
*Digitaria sp.*  
*Phragmites australis*  
*Bouteloua curtipendula*  
*Bothriochloa laguriudes subsp. torreyana*  
*Tridens muticus*  
*Celtis laevigata*  
*Panicum virgatum*  
*Sporobolous compositus*  
*Nassella leucotrica*  
*Aristida sp.*  
*tridens albescens*  
*Elymus sp.*

### **Vines and Forbs**

Aster sp.  
 Balloonvine

*Asteraceae sp.*  
*Cardiospermum halicacabum*

Beebalm  
 Bindweed  
 Broomweed  
 Illinois bundle-flower  
 Clover  
 Cocklebur  
 Common frogfruit  
 Common greenbrier  
 Common ragweed  
 Common sunflower  
 Common trumpet-creeper  
 Coral-berry  
 Curly dock  
 Dewberry  
 Doveweed  
 Engelmann's daisy  
 Giant ragweed  
 Golden-rod  
 Hedge-parsley  
 Henbit  
 Illinois bundle-flower  
 Indian mustard  
 Japanese honeysuckle  
 Locoweed  
 Maximilian sunflower  
 Mustang grape  
 Pepperweed  
 Poison ivy  
 Pokeweed  
 Prairie coneflower  
 Prickly pear  
 Saw greenbrier  
 Sedge  
 Sesbania  
 Silver-leaf nightshade  
 Smartweed  
 Softstem bulrush  
 Southern dewberry  
 Spike-rush  
 Stinging nettle

*Monarda citriodora*  
*Convolvulus arvensis*  
*Gutierrezia sp.*  
*Desmanthus illinoensis*  
*Trifolium sp.*  
*Xanthium strumarium*  
*Lippia nodiflora*  
*Smilax rotundifolia*  
*Ambrosia ertemisifolia*  
*Helianthus annuus*  
*Campsis radicans*  
*Cocculus carolinus*  
*Rumex crispus*  
*Rubus trivialis*  
*Croton monanthogynus*  
*Engelmannia peristenia*  
*Ambrosia trifida*  
*Salidago canadensis*  
*Torilis arvensis*  
*Lamium amplexicaule*  
*Desmanthus illinoensis*  
*Brassia juncea*  
*Lonicera japonica*  
*Astragalus sp.*  
*Helianthus maximiliana*  
*Vitis mustangensis*  
*Lepidium sp.*  
*Toxicodendron radicans*  
*Phytolacca americana*  
*Ratibida columnifera*  
*Opuntia sp.*  
*Smilax bona-nox*  
*Cyperus sp.*  
*Sesbania sp.*  
*Solanum elaeagnifolium*  
*Polygonum sp.*  
*Scirpus validus*  
*Rubus trivialis*  
*Eleocharis sp.*  
*Urtica chamaedryoides*

Storks-bill  
Sumpweed  
Texas dandelion  
Toothed spurge  
Virginia creeper  
Water pennywort  
Water-primrose  
Western ragweed  
Wild onion  
Wild violet

*Erodium sp.*  
*Iva annua*  
*Pyrrhopappus caroliniana*  
*Euphorbia denata*  
*Parthenocissus quinquefolia*  
*Hydrocotyle umbellata*  
*Ludwigia peploides*  
*Ambrosia psilostachya*  
*Allium sp.*  
*Viola sp.*

**Geographical Positions of the HEP Sites in the  
Riverside Oxbow Ecosystem Restoration Project  
on the West Fork of the Trinity River**

Site #	Position
002	32° 45' 32.8" N 97° 16' 18.0" W
003	32° 45' 38.4" N 97° 16' 25.3" W
111	32° 44' 56.7" N 97° 16' 56.4" W
112	32° 44' 54.7" N 97° 16' 52.7" W
113	32° 45' 13.1" N 97° 16' 34.7" W
114	32° 45' 10.29" N 97° 17' 30.25" W
115	32° 45' 20.28" N 97° 17' 36.62" W
116	32° 45' 27.40" N 97° 17' 35.23" W
117	32° 45' 15.56" N 97° 17' 38.46" W
118	32° 45' 11.53" N 97° 18' 0.55" W
119	32° 45' 11.37" N 97° 17' 3.31" W
120	32° 45' 25.0" N 97° 16' 34.6" W
121	32° 45' 29.8" N 97° 16' 53.9" W